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A
Mechanical Account
O F
POISONS,
In Several
ESSAYS.

BY -
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Coll. Med. Lond. & R. S. S.

Physician to his M A J E S T Y.

The THIRD EDITION, with large Additions.



L O N D O N,

Printed for J. BRINDLEY, Bookseller to His
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ADVERTISEMENT.

THIS Book was first published in the year 1702. and reprinted with very few additions, in 1708. I then really intended never more to trouble myself about it: But the demand for it having for many years been so great, as to tempt some Booksellers to print it twice or thrice, very uncorrectly, in a *piratical* way (as they call it) without my knowledge; I have thought it right, both in justice to the public and myself, to give a new edition of it.

It will easily be believed, that after more than forty years (spent

neither without study nor experience) I cannot be fond of a little performance in phyfic, written at a time of life, in which the facts must, for the most part, be taken from other authors, and the reasonings upon them would often require more patient thinking, and a riper judgment. And therefore I make no doubt but the public always made great allowances upon this account, when they gave the book so favourable a reception.

IN return to this kind usage, I have now taken some pains to reconsider my subject. Besides many other improvements, I have often from my theory drawn observations useful, as I imagine, in practice. Neither have I been ashamed, on some occasions, (as the *Latins* said) *Caedere vineta mea*,
to

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to retrench or alter whatever I have judged to be wrong. *Dies diem docet*. I think truth never comes so well recommended as from one who owns his error: and it is allowed that our first master, *Hippocrates*, never shewed more wisdom and greatness of mind, than in confessing his mistake, in taking a *Fracture* of the skull for the natural *Suture* (*a*); and the compliment, which *Celsus* (*b*) makes to him on this occasion, is very remarkable and just.

I MIGHT however urge in my excuse, that as the notions I have retracted regard chiefly the nervous fluid and its properties, so my new reasonings are founded upon experiments of electricity and attraction, applied to this fluid, which at the

(*a*) Epidem. lib. v. § 14.

(*b*) Medicin. lib. viii. c. 4.

time of my writing were not yet known. The instructive *Queries* and *Suppositions* of Sir *Isaac Newton*, and the surprizing electrical operations of Mr. *Stephen Gray* (c), improved by Monsieur *Du Fay*, at *Paris* (d), had not then enlightened the learned world.

BUT there are here two additions, which I ought particularly to mention: The first is the *Introduction*. Having observed, that the action of poisons, though they are of very different kinds, is generally uniform; and also that the animal spirits are first affected by it; I have thought it proper, as this opinion may seem somewhat strange and singular, to premise an inquiry into the nature of the nervous

(c) Vid. Phil. Transf.

(d) Vid. Memoires de l'Academie, 1733, 1734, 1737.

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fluid, of which it must be owned that we know too little. And if, in a matter so abstruse and difficult, what I have advanced has more in it of conjecture than of demonstration, it may be allowed to be something

*Quadam prodire tenus, si non datur
ultra (e).*

Whoever will pass a judgment upon such nice speculations, must take the whole scheme together. Truth is always a connected scheme; and inferences justly drawn not only illustrate but confirm one another.

THE other addition is, “An
“ anatomical description of those
“ parts in a Viper and in a Rattle-
“ Snake, which are concerned in

(e) Horat. Epist. i. v. 32.

“ their

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“ their poison,” by our great anatomist the learned and ingenious Dr. *Nicholls*. He having taken notice, that the *Anatomical Observations on the Viper*, by Dr. *Areskine*, in the first edition, were neither complete, nor in every point true, has been pleased to give a new anatomy of the whole head, not only of the common Viper, but also of that larger kind of it, the Rattle-Snake: that so those parts, which cannot so easily be seen in the smaller, may more distinctly appear in the bigger animal. How accurately he has performed this task, and how thoroughly he has explained the mechanism and offices of the several organs, any one may judge, who will compare his descriptions with the best of those, which have been hitherto made by other anatomists.

THE
P R E F A C E
TO THE
F I R S T E D I T I O N.

TO give an exact and particular account of the nature and manner the action of Poisons, is no easy matter; but to discourse more intelligibly of them than authors have hitherto done, not very difficult. One may without much pains shew their effects to be owing to something more than the bare qualities of heat or cold; and discover the footsteps of mechanism in those surprising phaenomena, which are commonly ascribed to some occult or unknown principle. But to unravel the springs of the several motions, upon which such appearances depend,

B

pend, and trace up all the symptoms to their first causes, requires some art as well as labour: and that both upon the account of the exquisite fineness, and marvellous composition, of the animal machine in which they are transacted, and of the minuteness of those bodies, which have the force to induce in it such sudden and violent alterations.

I HAVE attempted somewhat this way in the following Essays; in which I do not promise methodical and finished treatises, but only some short hints of natural history, and rude strokes of reasoning: which, if put together and rightly improved, may perhaps serve to furnish out a more tolerable Specimen of the Doctrine of Poisons, than has yet been published.

THE first draught of this small piece I made some years since, entertaining

tertaining myself at leisure hours with experiments on Vipers, and other venomous creatures; examining now and then the texture of Arsenic, Mercury Sublimate, and the like malignant substances; turning over what authors had said on the several subjects, and making such remarks as from time to time occurred.

THESE continued inquiries made up at last three or four short discourses; which when I began to digest into order, the increase of business contracted the intervals of my spare time: and the diversion of such studies quickly giving way to the severity of more necessary labours, they were quite thrown by. Till talking not long since with Dr. Areskine concerning the Viper, I took occasion to review my scattered papers, and confirm my reasonings by new experiments. He very readily

B 2

dily offered me his Anatomical Observations. These I have put at the end of the first Essay: which do not promise a complete dissection of the animal, but chiefly shew the make of those parts, which are concerned in the poison.

My design, in thinking of these matters, was, to try how far I could carry mechanical considerations in accounting for those surprizing changes, which Poisons make in an animal body; concluding (as I think, fairly) that if so abstruse phaenomena as these come under the known laws of motion, it might very well be taken for granted, that the more obvious appearances in the same fabric are owing to such causes as are within the reach of geometrical reasoning: and that therefore as the first step towards the removal of a disease is to know its origin, so he is
likely

likely to be the best physician, who, having the same assistance of observations and histories with others, best understands the human oeconomy, the texture of the parts, motions of the fluids, and the power which other bodies have to make alterations in any of these.

NOR indeed ought any one to doubt of this, who considers that the animal compages is not an irregular mass, and disorderly jumble of atoms, but the contrivance of infinite wisdom, and the master-piece of that creating power, who has been pleased to do all things by established laws and rules, and that harmony and proportion should be the beauty of all his works.

IT were therefore heartily to be wish'd, that those gentlemen, who are so much afraid of introducing mathematical

mathematical studies, that is, demonstration and truth, into the practice of Physic, were so far at least instructed in the necessary disciplines, as to be able to pass a true judgment, what progress and advances may be made this way. They would not then perhaps decry an attempt of so much moment to the welfare of mankind, as vain and impossible; because it is difficult, and requires application and pains.

IT is very evident, that all other methods of improving Medicine have been found ineffectual, by the stand it was at for above two thousand years: and that since of late Mathematicians have set themselves to the study of it, men already begin to talk so intelligibly and comprehensibly, even about abstruse matters, that it may be hoped in a short time, if those, who are designed for this profession,
are

are early, while their minds and bodies are patient of labour and toil, initiated in the knowledge of numbers and geometry, that mathematical learning will be the distinguishing mark of a physician from a quack ; and that he, who wants this necessary qualification, will be as ridiculous as one without Greek or Latin.

I HAVE, as to what regards the animal oeconomy, referred as much as I could to the works of Bellini, which have brought great light into the dark regions of Physic, and taught us to argue clearly and consistently, instead of amusing our selves with unintelligible words or precarious hypotheses. The Dissertations of Dr. Pitcairne, the honour of his profession in Scotland, are a convincing proof of the advantage of such a mechanical way of reasoning: nor could malice it self deny this, were
not

not ignorance in confederacy with it, which will secure any one from being benefited by the most useful demonstrations.

NOTWITHSTANDING *this*, I have been forced now and then to make digressions from my subject, to clear some doctrines necessary to be known, which have not been explained by others. For indeed the data, from which we argue in these matters, are by many too few. Dr. Cheyne, the Author of the New Theory of Fevers, has enumerated several particulars, in which the theoretic part of Medicine still wants improvement. If these deficiencies were made good, we might with more ease proceed in our inquiries into human nature, and should soon convince the world, that the most useful of arts, if duly cultivated, is more than mere conjecture, or base empiricism.

As

As to the authors I have made use of, who have treated of Poisons, I have quoted only those, who furnished me with matter of fact: for there are but few originals; and very large volumes on this subject many times contain little more than a collection of vulgar errors.

I HAD once thought to have carried these searches farther; in particular, besides what is occasionally mentioned in the last Essay concerning infection in acute diseases, to have inquired into the nature of contagious and hereditary distempers. But the humour of scribbling would not hold out; and some perhaps will say, 'tis well enough it did not: for I am not ignorant how few I am like to please. If it be hard to think and write justly, 'tis harder yet to bring others to one's own taste; nor shall I be at all angry, if to many
C I have

I have afforded matter of satyr and invective: less wit suffices for these than for the discovery of useful truths. They who have no smattering of mathematical knowledge, are incompetent judges of what service I have done towards the improvement of the theory, or practice of medicine: and those who are acquainted with these matters, will, it may be, think it something to talk intelligibly on such difficult and abstruse points. I neither want applause, nor fear censure: and therefore be the fate of these papers what it will, as they were first penned for my own satisfaction, and innocent entertainment; so I am resolved they shall never engage me in the trouble of quarrels or disputes.

London, 1702.

C O N-

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INTRO-

INTRODUCTION.

THOSE things, which are experienced to be in their whole nature, or in their most remarkable properties, so contrary to the animal life, as in a small quantity to prove destructive to it, are called Poisons: whether they are hurtful by being taken inwardly at the mouth, or communicated to the body externally by a wound.

THIS subject has afforded matter for great disputes among philosophers, in their inquiries into the frame of the world. Some have made it an objection to the goodness of
of

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of the Creator, that there should be any such productions as Poisons in nature: On the other hand, *Paracelsus, Van Helmont*, and their followers, fond of magnifying their chemical art, tell us, that poisons are really designed for other purposes than is commonly thought; they being indeed great medicines, when their concealed useful qualities are, by our study and labour, discovered and brought out of them. (a) To prove this, they alledge that remarkable saying of the wise man (b): “God made not death,
“neither hath he pleasure in the
“destruction of the living. For he
“created all things, that they might
“have their being; and the generations of the world were health-
“ful: and there is no poison of de-

(a) Vid. J. B. Van Helmont opera, pag. 373.

(b) Wisdom of Solomon, cap. i. v. 13.

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“struction in them, nor the kingdom of death upon the earth.”

As the knowledge of those minute philosophers, who find faults in the disposition of the universe, is generally too superficial; so I doubt the reasoning against them of our adepts, whose sight is often dazzled by the light of their furnaces, will, in the present affair, appear too deep, and far-fetched. For it does not look like universal beneficence, to create substances, whose manifest and obvious qualities are noxious and destructive, though they may have other virtues which are salutary, but which are only to be extricated from them by deep searches of art, and the torture of the fire.

THE true state of the case seems to be this. The productions of nature

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nature of this kind, as to us, are often medicinal, either in the external or internal use of them; and experience, improved by reasoning, teaches us to prepare and apply them to various purposes: But they are also not only phyfic, but even food to some other animals, which, by natural instinct, devour them; and these themselves afford not only good nourishment, but sometimes remedies to us. Little insects, which we think troublesome, are necessary to the life of wholesome birds and other creatures. Goats and quails are fattened by hellebore (*c*), starlings by hemlock (*d*), and hogs innocently eat henbane (*e*); all which we call poisonous. Many

(*c*) Lucret. lib. iv. 645.

(*d*) Galen. Simpl. Medic. Fac. 1. iii. c. 18.

(*e*) Sext. Empiric. Hypoth. Emp. i.

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instances might be given of the like kind. Will any one say that the venom of the *Viper* is not made for our good, when without it (as will be observed in the following discourse) this Reptile could not have been provided with those noble qualities, which render it effectual against some very stubborn diseases?

BUT this question may perhaps seem more difficult with regard to poisonous minerals: as, for instance, arsenic, which we find to be diffused almost through the whole mineral kingdom. Now it must be observed, that this is not a perfect mineral, but an active substance, made use of by Nature in preparing several metals in the earth, which are of great service to mankind. It particularly appears to be so in the growth of
D silver,

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silver, copper, tin and lead; the ores of all which contain, besides common sulphur, a great deal of arsenic: so that this, in the language of the chemists, may be called a mineralising principle. And the case will be found to be much the same in all natural productions of this kind.

IN short, there is in the fabric of the world a great chain and dependency of things upon one another: and though our knowledge does not reach to every particular link of it, yet the farther we advance in the study of Nature, the more we shall find that

Whatever is, is right (f).

But how much more would it ap-

(f) Pope's Essay on Man, Epist. i.

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pear to be so, could we look into the whole system of the universe, and see the relation which our world perhaps bears to some of those innumerable others in the Immense Space, which the Almighty Being may probably have made dependent upon one another by established laws and order!

As to the text cited out of *Solomon*, the meaning of it is plainly this. “ God created nothing
“ to be destructive to mankind,
“ but gave to all things their
“ proper nature ; and the productions of the world are wholesome. Even Poisons were not
“ designed to be hurtful, but for
“ good uses: for in all the earth
“ there are provisions made against
“ death.”

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BEFORE we proceed to particulars, it may not be improper to give a general idea of Poisons, to explain in what manner they act, and by what alterations made in our bodies they become so hurtful.

Now as to this, it will appear from the following discourses, that though Poisons are of different kinds, as well those which kill by wounds, as those which are taken inwardly; yet there is a great agreement in the manner of producing their effects: and that even internal Poisons exert their force in a manner analogous to the external.

VENOMOUS animals, when they bite or sting, inflict a wound, and
instil

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inſtil into it a drop or more of liquor, which infects the fluid of the nerves, and by this means inflames the membranes: hereupon a ſwelling ariſes, ſometimes to a degree of mortification, which ſpreads to the neighbouring parts.

POISONOUS ſubſtances, being ſwallowed, wound the nervous coat of the ſtomach. An inflammation enſues, which, according as the poiſon is of a greater or leſſer power, is communicated to the contiguous coats; and in ſome caſes, eſpecially if it be of a mineral nature, ends in a perfect gangrene. For the difference between mineral and vegetable Poiſons lies chiefly in this, that the former are of greater force than the latter.

BUT

BUT in all accidents of this kind, whether the wound be outward or inward, the mischief does not stop at the part affected, but is carried farther, even through the whole body.

THIS is done by the great activity of the nervous fluid, one part of which being infected immediately taints all the rest: and thus the whole system of nervous expansions is drawn into spasms and convulsions; and, according to the different offices of the parts to which they belong, produce different symptoms. In the stomach and intestines, these spasms cause sickness, vomitings and gripes; in the brain, *deliria*, sleepiness and epileptic fits; in the heart, intermissions of the arterial pulse, palpitations

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pitations and swoonings ; in the lungs, difficulty of breathing, with strangling and suffocations ; in the liver, by the spasmodic contraction of the biliary ducts, the bile is returned into the blood, and makes a jaundice ; in the kidneys, the same disposition of the urinary canals interrupts the secretion of urine, and makes it quite irregular. In short, the animal oeconomy is all disturbed : and though different poisons may shew their most remarkable effects in different parts, and these, according to the violence of the hurt, may appear in very different degrees ; yet the symptoms always make it plain, that the first bad impression is made upon the animal spirits.

I HAVE in another place shewn,
from the manner in which persons
are

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are seized in pestilential fevers, that is, with faintness, giddiness, palpitations of the heart, tremblings, *etc.* that the nervous fluid is likewise principally affected in these diseases; contagion being indeed a real poison (*g*).

It will therefore be proper to inquire into the nature of this liquor: for I think no regard ought to be had to the immechanical notions of those authors, who imagine that there is no such thing in an animal body; and that muscular motion and sensation are performed only by the vibrations of the fibres of the nerves, without the intervention of any spirituous fluid.

(*g*) Vid. Discourse on the Plague.

THEY

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THEY who can satisfy themselves with such a scheme, seem to have very little attended to what is transacted within us, in the effects of sudden passions of the mind; in the instantaneous translations of diseases from one part to another, as particularly in the gouty humour; and in the surprising changes, made sometimes in a moment, in the secretions of those liquors upon which life depends.

BUT, to say no more, as the brain is manifestly a large gland, with a most exquisite *apparatus* for the separation of a liquor from the blood; this must, like all other glands, have an excretory duct: Now the nerves are evidently contrived for this purpose, and consequently

E quently

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quently must always contain a proper subtile juice.

To proceed therefore ; this fluid, so far as we can discover by its effects, is a thin volatil liquor, of great force and elasticity ; being indeed most probably a quantity of the *universal elastic Matter*, incorporated with fine parts of the blood, separated in the brain, and lodged in the fibres of the nerves. This is the instrument of muscular motion and sensation, a great agent in secretions, and indeed in the whole business of the animal oeconomy.

By the universal elastic matter I understand that subtile and active substance, diffused throughout the universe, which our great philosopher,

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pher, Sir *Isaac Newton*, supposes to be the cause of the refraction and reflexion of the rays of light, and by the vibrations of which light communicates heat to bodies; and which readily pervading all bodies, produces many of their actions upon one another.

I REFER, for the sentiments of this divine man, to his *Opticks* (*b*); but more especially to a most remarkable letter of his to the honourable Mr. *Boyle*, written many years since (*i*). Whoever thoroughly comprehends and considers what is delivered in these Pieces, under the form of *Queries* and *Suppositions*, will be let into some know-

(*b*) Qu. 23, 24.

(*i*) Published in the life of Mr. Boyle, prefixed to his works, pag. 70. which life is since printed by itself.

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ledge of the secret springs of nature; and will then, I hope, be inclined to think, that I have not been wrong in endeavouring to introduce the same principles from the inanimate into the animated world.

It seems very reasonable, from that uniformity which there is in the laws of nature, to conclude that the animal spirits are something of this kind: for there can be no greater presumption in favour of a scheme, than that it is simple, and of a piece with the known system of the universe.

Now, an active substance of this kind in the nerves must necessarily be very susceptible of alterations from other bodies of extreme minuteness and great force:
In

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In like manner, as we see some chemical liquors, upon their first approach to each other, to fall into fermentations, the result of which is a compound mixture of a quite different nature from what might have been expected from the single ingredients.

THUS the compound spirit of nitre put to oil of cloves will effervesce even to a flame : a Fermentation being indeed no more than the attraction and repulsion of the particles of different bodies, when they come together.

By reflecting upon the *phaenomena*, which the experiments of late years made upon electricity (*k*)

(*k*) Philos. Transact. N^o 366. 417. 422.
423. 426. 436. 439. 444.

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have discovered to the world, and viewing the attractions and repulsions of the finest particles of electrical substances, any one may easily form an idea of this animal fluid, and of the excessive force and velocity with which it acts.

It is very observable, that the communication of electricity is much greater thro' animal than thro' inanimate bodies: that is, the elastic fluid passing thro' these meets with a greater quantity of the same matter in them than in the other; the solid animal fibres being more adapted to receive it. The experiment of the boy suspended on silk or hair Lines (*l*) is equally surprising and instructive, demonstrating this elastic spirit, even to

(*l*) Philosoph. Transact, N^o. 417.

our sight and touch : And if the nerves, as Sir *Isaac Newton* supposes, are very small, but solid, pellucid and uniform *capillamenta*, wrapt up in bundles ; the glass tube rubbed by the hand, and its action with the elastic fluid, represent to us in some degree the nerves and the animal spirits lodged in them.

PERHAPS the prosecution of such trials upon living creatures, may in time make us more acquainted with the laws and actions of this Impetuous Part, (as *Hippocrates* (*m*) calls it) in the animal machine.

Ita res accendunt lumina rebus (*n*).

(*m*) Epidem. lib. vi. § 8. Τα θερμῶντα σώματα.

(*n*) Lucret. lib. i. v. 1110.

IT is sufficient to our present purpose, to have described the nervous fluid so far as to shew it to be such a one as is indowed with great activity and force, and therefore capable of receiving various alterations from other bodies, especially such as consist likewise of very subtile and powerful particles: and all Poisons, we know, are of this kind.

I WAS of opinion, when I first wrote these *Essays*, that the effects of Poisons, especially those from venomous animals, might be accounted for by their affecting the blood only: But the consideration of the suddenness of their mischief, too quick to be brought about in the course of the Circulation, (for the bite of a Rattle-Snake killed a
dog

dog in less than a quarter of a minute (*o*), together with the nature of the symptoms intirely nervous, induced me to change my sentiments. For if, as Dr. *Keil* has computed (*p*), the velocity of the blood is more than five thousand times leffer at the fortieth branch from the great artery, than it is in this artery before any ramification is made from it; how is it possible that the brain, heart, *etc.* should feel so sudden a hurt, unless it were conveyed to them by a *medium* of much greater quickness? and this can be no other than the animal spirits.

Neither is it amiss to add, that the observations I have

(*o*) Philosoph. Transact. N^o. 399.

(*p*) Vid. Tent. Medico-Physic. 2.

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made, if improved, may also afford hints useful in the cure of many diseases. For, though some of those distempers, which we call nervous, as particularly paralytic weaknesses, may be accounted for by irregular motions and obstructions of the animal spirits only; yet many of them certainly must arise from ill affections of the spirituous fluid itself. It can, for instance, never be conceived that the surprizing appearances in phrenitical, maniacal, and melancholy disorders, should be brought about without alterations, suitable to the different cases, made in that active liquor, by which the mind governs the body.

THERE are many other cases, judged extraordinary, and not easily to be explained, which depend
almost

almost solely on the animal spirits. I shall mention only one.

A SURGEON of great merit and experience, in a very useful Book, lately published (*q*), has observed, that sometimes in gun-shot wounds, attended with a great laceration of the membranes, though things seem to go on well for some days, yet the patient is suddenly seized with convulsions in his face, which so fix the jaws that he cannot speak, though the senses are not impaired, and inevitably dies. It is, I think, very plain, that this dreadful symptom must be owing to the bad condition of the nervous liquor, which it is brought into by the tearing of the mem-

(*q*) Ranby, on gun-shot wounds, p. 72.

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branes, and which, notwithstanding the tolerable state of the blood, does, by its own disorder, produce fatal consequences.

AND, as we see in the mentioned electrical experiments, how remarkably the subtile matter is altered in its motions and effects, even by the simple contact of other bodies; it must certainly be allowed, that when the same comes to be incorporated with the finest part of the blood, it will, according to the condition in which this is, make a fluid, elastic indeed, but at different times in a different degree, and therefore variously affected by external agents.

BUT to return to Poisons: As the different state of the nervous fluid may in some measure alter
their

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their effects, so likewise these themselves, though really of the same kind, may yet so differ in their force and degree of action, as to be hurtful in various and seemingly different ways.

UPON this consideration, the surprizing stories related by authors, of the different deaths inflicted by Serpents of different kinds, particularly in *Africa*, are not at all incredible. I very well remember, that the learned *Paul Herman*, many years ago professor of botany in the university of *Leyden*, who had lived a great while in *India*, affirmed, that there were also in several parts of that country, venomous creatures of the same kind with those described by the *African* historians, which killed by very different

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ferent effects of their Poison: and that upon due inquiry into facts, he was convinced that the beautiful descriptions in *Lucan* (r) of the various species of *Vipers*, which *Cato* met with in the hot *Libyan* deserts, were not poetical fictions, but taken from Nature. He had in his *Museum*, preserved in spirit of wine, several of these very Serpents ; particularly, the *Aspis*, called *Nintipolongha Zeylanica*; whose bite induced a deadly sleep; the *Dipsas*, or *Situla Macassarica*, which killed with an unquenchable thirst; and the *Haemorrhous Macassaricus*, the poison of which was immediately followed by *Haemorrhages* from all the pores of the body.

(r) Lib. ix.

FOR

FOR, we must observe likewise, that although the first impression of the Poison be made upon the nervous spirit, yet the whole mass of blood very quickly partakes of the hurt: not, I suppose, from any mixture of the venom with it, but from such a corruption of it, as an irregular circulation, interrupted secretions, and stagnations in the smallest vessels, (the consequences of a vitiated nervous fluid) may naturally produce. Nor will this seem strange, since such a compounded liquor, as the blood is, may certainly undergo any imaginable changes by alterations made in its motion only.

THUS much concerning the general action of Poisons: The effects

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fects of the particular kinds of them, described in the following Discourses, will (at least in my opinion) be so many proofs of the truth of the doctrine I have advanced.

ESSAY

ESSAY I.

Of the V I P E R.

THE Viper has always been so remarkable for its venom, that the most remote antiquity made it an emblem of what is hurtful and destructive. Nay, so terrible was the nature of these creatures, that they were very commonly thought to be sent as executioners of divine vengeance upon mankind for enormous crimes, which had escaped the common course of justice. Thus *Herodotus* (a) and *Aelian* (b) do both take notice that

(a) Lib. ii. cap. 74.

(b) De Animalib. lib. xvii. c. 5.

Adders were sacred among those masters of learning and superstition the *Aegyptians*: that they affirmed of one sort of them particularly, that they were made to be ministers of the will of the gods, by averting evil from good men, and punishing the bad. Therefore the goddess *Isis* was represented with an *Asp* upon her head (c) to denote both her wisdom and power. And from her the *Greeks* and *Romans* honoured *Minerva* with the same symbol; as she often appears dressed in antique statues and gems. And *Pausanias* (d) observes of the *Arabians*, that they forbore to offer any violence to the *Vipers* which were found near the *Balsam-tree*,

(c) *Aspide cincta comas*——— *Valer. Flacc. Argonautic. lib. iv. ver. 418. Dextrâ laevâque fulcis insurgentium viperarum cohibita. Apuleius Metam. lib. ii. p. m. 240.*

(d) *Boeotic. p. m. 303.*

as reputing them holy. The footsteps of which superstition still remain among these people to this very day: for *Veslingius* (*e*) saw many of them take these creatures into their houses, feed them, and worship them as the *Genii* of the place. The same odd fancy obtains in the *East-Indies*: for the king of *Calicut* causes cottages to be set up for serpents to keep them from the rain, and makes it death to any that shall hurt one of them; thinking them to be heavenly spirits, because they can so suddenly kill men (*f*). A remarkable instance of such an opinion as this we have in the history of *St. Paul* (*g*), whom the people of *Malta*, when they saw the Viper leap

(*e*) Not. in Alpin. de Plant. Aegypt. cap. 14.

(*f*) *Purchas's Pilgrimage*, lib. v. c. 12.

(*g*) Act. Apost. chap. xxviii.

upon his hand, presently concluded to be a murderer; and as readily made a god of him, when, instead of having his hand inflamed, or falling down dead, (one or other of which is usually the effect of those bites) he without any harm shook the beast into the fire: it being obvious enough to imagine, that he must stand in a near relation at least to the gods themselves, who could thus command the messengers of their vengeance, and counterwork the effects of such powerful agents.

I have sometimes thought that this might be the reason why antiquity not only represented the first masters of Physic, *Hermes, Aesculapius, Hippocrates, etc.* in their statues and medals, with a Viper added to their figure, but also worshipped them under this form:
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for diseases in those days, especially the most violent, plagues, fevers, *etc.* were in like manner, as these creatures, reputed the commissioned messengers of divine anger and displeasure (*b*). They therefore, who by their art could cure and stop the course of these, as they were supposed to do this by the particular leave and assistance of heaven, so had honours paid to them accordingly; and this representation was in the nature of an hieroglyphic character: for, as the learned *Spanheim* observes (*i*), the Viper was a symbol or emblem of divine power.

(*b*) Cornel. Cels. praefat. in medicin. *Morbos ait ad iram deorum immortalium relatos esse, et ab iisdem opem posci solitam.*

(*i*) Divinae potentiae symbolum. Vid. Ezech. Spanhem. De usu Numismat. p. m. 125, 126, et 181, et seq.

BUT to say the truth, that which the antients made the symbol of health does not seem to have been the *Viper*, but the innocent *Snake* or *Serpent* of that kind, of which *Lucan* speaks (*k*):

*Vos quoq; qui cunctis innoxia numina terris
Serpitis, aurato nitidi fulgore dracones.*

And if so, the reason *Macrobius* gives for this custom may be a very good one, which is from the property all serpents have of casting their *Exuviae*, or upper skin, every year, which makes them fit emblems or representations of health: the recovery whereof from sickness and diseases may justly be looked upon as the beginning of a fresh period of life, and (as the

(*k*) *Pharfal. lib. ix. ver. 729.*

throwing off the *Senectus* of these creatures seems to be) the renewing of age (*l*).

BE that as it will, certain it is that such fond and superstitious fancies concerning the Viper, together with the mistaken opinion that few of its parts were exempt from poison, did not suffer the antients to make any curious enquiries into its nature by anatomy and experiments. And this is the cause of the many errors they have delivered down to us in these points; which by gradual advances have since been rectified, and the inward make, properties, and genera-

(*l*) Ideo simulacris eorum [Aesculapii et Salutis] junguntur figurae draconum, quia praestant ut humana corpora, velut infirmitatis pelle depositâ, ad pristinum revirescant vigorem: ut virescunt dracones per annos singulos, pelle senectutis exutâ. Saturnal. lib. i. c. 20.

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tion of this animal, have been largely treated of : more especially M. *Redi* (*m*), *Charas* (*n*), and Dr. *Tyson* in his *Dissection of the Rattle-Snake* (*o*), which is a larger species of a Viper, have taken pains on this subject, to whose discoveries, what is yet wanting we shall add at the end of this Essay.

THE symptoms which follow upon the bite of a Viper, when it fastens either one or both its greater teeth in any part of the body, are an acute pain in the place wounded, with a swelling at first red, but afterwards livid, which by degrees spreads farther to the neighbouring parts ; with great faintness, and a quick, though low, and sometimes

(*m*) Osservazioni intorno alle vipere.

(*n*) Nouvelles experiences sur la vipere.

(*o*) Philosophical Transactions, vol. xii. N^o. 144.

interrupted pulse, great sickness at the stomach, with bilious, convulsive vomitings, cold sweats, and sometimes pains about the navel; and if the cure be not speedy, death itself, unless the strength of nature prove sufficient to overcome these disorders: and though it does, the swelling still continues inflamed for some time; nay, in some cases more considerably upon the abating of the other symptoms, than at the beginning. And often from the small wound runs a sanious liquor, and little pustules are raised about it: the colour of the whole skin, in less than an hour, is changed yellow, as if the patient had the jaundice.

THESE mischiefs (although different climates, season of the year more or less hot, the greater or lesser rage of the Viper, the animal

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itself of a larger or smaller size, and consequently able to communicate more or less venom, the wound made deeper, in a part more nervous or tendinous, and therefore receiving more of the poisonous liquor, and the like circumstances, may variously heighten or abate them, yet) usually discover themselves much after the same manner in all: unless the bite happen not to be accompanied with the effusion of that liquor, which is the main instrument and cause of this violent and shocking disturbance.

BUT before I proceed to enquire into the nature and manner of the acting of this juice, it may not be improper to take notice, that the true use of it is to perform an office of so great moment to the preservation of the individual, that
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without it this creature could not subsist.

FOR Vipers live chiefly upon lizards, frogs, toads, mice, moles, and the like animals, which they do not chew, but swallow down whole; in which manner they lie in the stomach, or if that be not big enough to receive them, partly in that, and partly in the *oesophagus*, which is membranous and capable of great distension; till by the salival juices of those parts, together with the help of the fibres of the stomach, and the contraction of the muscles of the *abdomen*, they are gradually dissolved into a fluid substance, fit for the nourishment of their bodies, which is the work of many days. This is one reason why these creatures can live so long without taking any fresh food, which I have known them to do

five or six months ; as another is, that their blood is a groffer and more viscid fluid than that of most other animals: so that there is but a very little expence of it by transpiration, and consequently less need of recruit. This not only Microscopes discover, but reason teaches : because there is but very little muscular force in the stomach to comminute the food, and make a chyle of fine parts ; and therefore the blood must accordingly be of a tough and clammy consistence. Besides, the heart of a Viper has properly but one ventricle, and the circulation of the blood is performed after the same manner as it is in a frog and tortoise, in which not above one third of it passes through the lungs: upon which account its comminution in them by the air is proportionally lesser than in other animals. Now
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such a manner of feeding as this does necessarily require, that the prey should upon the first catching be immediately killed: otherwise it were by no means fit to be let into the stomach. For we are not to think that the force of this part would be alone sufficient to destroy it, the subtilty of a living creature (besides the consideration of the weakness of the fibres) being in a great measure able to elude that; as indeed we every day find live animals in the ventricles of others: and therefore to do this is the proper use both of the teeth and their poison; for which being designed and adapted, it is no wonder if the Viper, this same way by which it destroys its prey, proves sometimes mischievous to any other creatures besides, when it happens to be enraged, or by any provocation stirred up to bite.

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THE description of the poisonous fangs, their make, articulation and motion, as also of the glands that separate the yellowish liquor, and the bags that contain it, I shall give, together with some anatomical observations, at the end of this discourse.

THIS venomous juice itself is of so inconsiderable a quantity, that it is no more than one good drop that does the execution. And for this reason authors have contented themselves with trials of the bite upon several animals, never essaying to examine the texture and make of the liquor itself: for which purpose I have oftentimes by holding a Viper advantageously, and incraging it till it struck out its teeth, made it to bite upon somewhat solid, so as to void its poison; which

which carefully putting upon a glass plate, I have with a Microscope, as nicely as I could, viewed its parts and composition.

UPON the first sight I could discover nothing but a parcel of small salts nimbly floating in the liquor; but in a very short time the appearance was changed, and these saline particles were now shot out as it were into crystals of an incredible tenuity and sharpness, with something like knots here and there, from which they seemed to proceed: so that the whole texture did in a manner represent a Spider's web, though infinitely finer, and more minute; and yet withal so rigid were these pellucid *spicula*, or darts, that they remained unaltered upon my glass for several months (*p*).

(*p*) Vid. Tab. i. Fig. 10.

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I have tried several ways to find out, if I could, under what tribe of salts these crystals are to be ranged, and to discover what alterations they make in the blood: and not without some difficulty, by reason of the minute quantity of the liquor, and the hazard of experiments of this kind, some curious friends, and myself together, made the following observations.

ABOUT half an ounce of human blood received into a warm glass, in which were five or six grains of the viperine poison newly ejected, was not visibly altered either in colour or consistence: It then was, and remained undistinguishable from the same blood, taken into another glass, in which was no poison at all.

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THESE portions of blood were severally mixed with acids and alkalis: the empoisoned blood was, after such mixtures, of the same colour and consistence as the other.

SPIRIT of nitre, spirit of salt, and juice of lemons, severally poured upon the *sanies* itself, produced neither fermentation, nor any change of colour.

SALT of tartar run *per deliquium*, and the simple spirit of hartshorn, dropped upon the venom, neither altered its colour, nor raised any ebullition.

SYRUP of violets mixt with the poison did not change its colour either to red or green.

THE tincture of *heliotropium*, that is, blue paper, was not altered by the *sanies* ejected upon it: and this drying still retained its yellowish colour.

WE caused several animals, dogs, cats and pigeons, to be bit by an enraged Viper; which generally died, some in a longer, others in a shorter space of time. But we constantly observed, that they all immediately upon the bite, shewed, with signs of acute pain, marks of their life being affected by sickness, faintings, convulsions, *etc.*

THE head of a large Viper lay three hours after it was cut off: it was perfectly flaccid and without motion. A pigeon wounded upon the breast with the fangs of this head,

head, was presently convulsed, *etc.* as from the bite of the animal, and died in seven hours.

WE contrived a sharp steel needle to be made, crooked, in shape not unlike to the Viper's tooth, with a *sulcus* or hollow on the convex part, not far from the point: into this we put a drop of the venom, and with it wounded the nose of a young dog. It produced the usual disorders of vomiting, purging, *etc.* but in a less degree, and the dog recovered. It was remarkable, that upon making the wound the dog cried but little, till the poison came into it: but then he howled, *etc.* in the same manner as if bit by the Viper itself. But a pigeon pricked in the fleshy part of the breast by the same poisoned needle, suffered as from the

bite, and died in about eight hours.

WE made these last experiments, with a view to the controversy between Signor *Redi* in *Italy*, and Monsieur *Charas* in *France*. The former, from trials of the same kind with those we have now mentioned, affirmed that the venom of the Viper lay in the yellow liquor of the gums: The latter, in opposition to this, espoused a notion advanced first by *Van Helmont*, and placed it altogether in the enraged spirits of the creature, calling this yellow liquor a pure innocent *saliva*; and alledged in proof of his assertion, several experiments he made with a success quite different from that with which Signor *Redi* made his.

THE most that can be concluded from hence, I think, is this, that although the Vipers in *Italy* do not differ in their nature from those in *France*; yet there is a great deal of difference in the success of the same experiments, when faithfully and judiciously made, and when they are cautiously and timorously managed, lest they should happen to overthrow a darling hypothesis.

AND therefore, Monsieur *du Verney* in the Royal Academy, and Dr. *Areskine*, then at *Paris*, confirmed the opinion of Signor *Redi*, by several trials which they made with the same effect: as I was afterwards informed by the Doctor himself.

WE resolved to end our poison-enquiries by tasting the venomous liquor. Accordingly, having diluted a quantity of it, with a very little warm water, several of us ventured to put some of it upon the tip of our tongues. We all agreed, that it tasted very sharp and firey, as if the tongue had been struck through with something scalding or burning. This sensation went not off in two or three hours: and one gentleman, who would not be satisfied without trying a large drop undiluted, found his tongue swelled with a little inflammation, and the soreness lasted two days. But neither his nor our boldness was attended with any ill consequence.

THIS is no objection to the hurtful quality of this juice: for as
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some chemical liquors ferment with others of a certain kind only ; so these poisonous salts may affect one fluid of the body, and not another. Which that is, we shall shew anon. It is sufficient to the present purpose to say, that the saline *spicula* are broken and dissolved in the mouth by the clammy salival humour: and if any of them should pass thence into the stomach and intestines, the balsam of the bile will be an antidote there, powerful enough to overcome their force.

THESE experiments upon the Viper poison and the blood, are a sufficient confirmation of what has been advanced in the Introduction, that the nervous liquor only is affected by this venom ; and at the same time afford a convincing proof how much those scanty principles
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of our chemists acid and alkali fall short in explaining the actions of natural bodies : since neither of these salts could in any way be found to affect the viperine venom.

BEFORE I proceed, I must take notice, that even some of the antients were thus far rightly apprised of the nature of this poison. Of this *Galen* gives us testimony in several places ; particularly in his book *De temperamentis*, (q) where he takes notice, that “ nothing has
 “ the same power upon the human
 “ body outwardly as inwardly.
 “ Thus, (says he) neither the ve-
 “ nom of the Viper, nor of the
 “ Asp, nor frothy spittle of the
 “ mad Dog, are alike mischievous
 “ when they fall upon the skin,

(q) Lib. iii. cap. 2.

“ or enter into the stomach, as
 “ when outwardly communicated
 “ by a wound.”

AND therefore *Lucan*, (who being an historical poet, makes amends for what is wanting of invention, by the spirit and judgment always shewn in his descriptions) introduces brave *Cato*, when marching the remains of *Pompey's* army through *Africa*, very wisely telling the soldiers, almost choaked with thirst, yet afraid to drink of a spring they came to, because full of serpents (*r*):

*Noxia serpentum est admisto sanguine pestis :
 Morsu virus habent, et fatum dente minantur :
 Pocula morte carent*————

(*r*) *Lucan. Pharsal. lib. ix. v. 614.*

*Mixt with the blood, the serpent's poison kills :
The bite conveys it; death lurks in the teeth :
Swallow'd it works no harm——*

IN the like manner it was in those times also known, that the virulent juice had the same bad effects, when mixt with the juices of the body, by means of a common wound, as when communicated by the venomous bite. This made *Celsus* (s) advise, in sucking out the poison, to take care there be no ulcer in the mouth: though this caution be rather flighted and ridiculed by *Severinus* (t) and others; who hereby discover how little they understood of the seat and nature of this poison. And *Galen* (u) mentioning the story of

(s) Loc. ante citat.

(t) *Vipera Pythia*, p. 361.

(u) *De Theriac. ad Pison.* lib. i. c. 8. Vid. etiam c. 10.

Cleopatra,

Cleopatra, relates from other authors, that she killed herself by pouring the *virus* of an Asp into a wound made in her arm by her own teeth.

IN short, it is upon this foundation, that *Pliny* (x) assures us, the *Scythians* poisoned their arrows with the *sanies* of Vipers mixt with human blood. The way of doing it *Aristotle* (y) has at large related: and the *Tartars* are said to use the like trick to this day. After the same manner the *Indians* make use of the venom of the lizard, called *gecco*. This creature they hang up by the tail, and by whipping exasperate till it discharge its *virus*, in which they tinge their darts: and a

(x) Nat. Hist. lib. xi. c. 53. Scythae sagittas tingunt viperinâ sanie et humano sanguine: irremediabile id scelus.

(y) De mirabilibus.

very flight wound with these weapons is speedy death (z).

A later author, in his description of the cape of *Good Hope*, (a) informs us, that the way by which the inhabitants there, called *Hottentots*, kill great wild beasts, lions, tigers, elephants, *etc.* is this. They take the bladders of poison with their liquor, out of the gums of that deadly kind of serpents, which the *Portuguese* call *Cobras de Capello*: these they dry in the sun, and grind them to powder betwixt two stones. This powder they make into a paste with the spittle or flabber of the same creature: which paste they rub upon the

(z) Bont. Histor. Ind. lib. v. c. 5.

(a) Peter Kolben, printed at Norimberg, in High Dutch, 1719. pag. 532.

points of their darts, and lay them by to dry for their use.

HAVING in the Introduction explained in general the manner in which this poison, in common with all others of the animal kind, acts upon the body; I shall only here add the reason of one particular effect of it, which is thought very extraordinary and surprizing, that is, the *Jaundice*.

THE jaundice is a suffusion of bile upon the surface of the body, and indeed upon all the inward membranes also. The *bile* is a natural *sapo*, that is, a mixture of oil, water, and a salt both volatil and fixt, separated in the liver. That the secretion of it may be rightly performed, it is requisite (as in all animal secretions) that there be a due proportion of its
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several parts, and also that there be a right disposition of the secretory vessels. These compounding parts cannot be supposed to be altered in so short a time as is mentioned: but a constriction, or nervous spasms, may almost suddenly so straiten the orifices of the ducts, into which the bile is to pass, that its derivation into them will be stopt; and consequently it must remain in the blood, which in the course of circulation will discharge it upon the whole body.

THIS is a jaundice of the same kind with that which follows sometimes upon violent colic pains, in which the spasmodic contraction of the membranes of the *abdomen* interrupts the motion of the bile through the hepatic canals: the cure of which therefore is by plentiful

tiful dilution and anodyne medicines.

THE case is quite otherwise in the common jaundice, which is a disease of the liver. In this the fault lies in the bile itself. For though it is usually said, that this is an obstruction in the liver, yet it ought to be considered that the vessels are rarely obstructed but by the disorder of the liquors they carry; and consequently that an ill state of the bile must be, except in some extraordinary cases, antecedent to an obstruction in its ducts: and therefore, as the alterations of so compounded a fluid are different, so the jaundice is accordingly attended with different, nay sometimes with contrary symptoms. In some cases, without a fever, the *faeces* of the intestins are hard and white with great costiveness:

stiveness: in others, a *Diarrhoea* with a fever, and yellow discharges, weakens the patient. In the former (the consequent generally of an inactive sedentary life) for want of a due quantity of salt, the oily part of the bile grows viscid and thick, and stagnates in the ducts of the liver: in the other (owing to plentiful living, and drinking spirituous liquors) the volatil part of the salt prevails too much, and the bile becomes too thin, hot, and irritating.

THERE is another disease, which though it be thought to belong to another part, yet is indeed so much a-kin to the jaundice, that it may be properly mentioned on this occasion, I mean the *Diabetes*. For this is not, as physicians have commonly judged, a distemper of the kidneys, but of the liver, proceeding

ceeding likewise from a vitiated mixture of the bile. It happens most frequently to those, who without due exercise indulge themselves in drinking vinous liquors, and then quench their thirst arising from these, by too great a quantity of such as are cooling.

By such ill-timed heating and cooling of the humors of the body, the natural proportion of salt in the bile, by which its oily part is incorporated with the water, is not sufficient, now the water overabounds, to preserve the mixture: so that a great portion of this, together with some of the thinnest of the oil, will be discharged by the kidneys; and the urinary ducts will be greatly enlarged by a constant afflux that way. By which means the thicker oily particles are left in a degree of coagulation in

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the smaller tubes of the liver, and are there formed into a hard fatty substance.

THE dissection of those who have died of the *Diabetes* proves this to be so: For I have always found a *Steatomatous* collection in their liver, in appearance not unlike to what is often discharged by stools in a confirmed jaundice, but of a harder consistence.

As to the sweetness of the urine, this is all bilious: for the water of the bile separated from its salt is sweet. *Ox Gall*, by a chemical distillation, yields four parts in five of water (*b*). This I have observed to be fragrant, as if perfumed with Musk. The urine in the be-

(*b*) Vid. Haller. Not. in Boerhaav. Institut. Medic. §. 99.

ginning of a jaundice very often smells like violets; and in a *Diabetes* the flux is usually lessened towards the latter end of life, and the water is as bitter as gall: plain indications of a like origin of two distempers seemingly very different. Neither can I omit to take notice, that the cure of a *Diabetes* confirms these remarks. For this is chiefly done by supplying the blood with a quantity of fixt salt, particularly such as is contained in lime water, and in that of the hot well at *Bristol*, which is indeed a natural lime water. But what might be said on this subject would require a just discourse. It is time to come to the cure of the Viper-poison.

THERE was formerly in *Africa* a nation of people called *Psylli*, famous for the cure of the bite of

serpents, with which that country above all others abounds (c). These people were thought to have something in their constitution so contrary to poison, that no venomous creature would touch them: and it was pretended that they made this a trial of the legitimacy of their children. The truth of the matter is: they performed the cure in a manner very surprizing to the vulgar, that is, by applying their mouth to the wound, and sucking out the venom. The *Marsi* in *Italy* pretended to the same power. Some ceremonies, to over-awe the patient, and gain reverence to the operator, were added to the performance: but *Celsus*, the Latin *Hippocrates*,

(c) Vid. Plin. Hist. Nat. lib. vii. c. 2.
 Ælian. Hist. Animal. lib. i. c. 57.
 Et Lucan. lib. ix. v. 891.

has wisely observed, that “ These
 “ people had no particular skill
 “ in this management, but bold-
 “ nefs confirmed by use: for the
 “ poison of the serpent, as likewise
 “ some hunting poisons which the
 “ *Gauls* particularly make use of,
 “ are not hurtful in the mouth,
 “ but in a wound. Therefore
 “ whosoever will, after their ex-
 “ ample, suck the wound, will
 “ be in no danger himself, and
 “ will save the life of the wounded
 “ person (*d*). *Aristotle* has hinted
 something to this purpose. “ The
 “ spittle of a man (says he) is an

(*d*) Neque hercule scientiam praecipuam habent hi, qui Pfylli nominantur, sed audaciam usu ipso confirmatam. Nam venenum serpentis, ut quaedam etiam venatoria venena, quibus Galli praecipue utuntur, non gustu, sed in vulnere nocent. Ergo quisquis, exemplum Pfylli secutus, id vulnus exfluxerit, et ipse tutus erit, et tutum hominem praestabit. *Medicin. lib. v. c. 27.*

“ enemy

“ enemy to the bites of most
 “ serpents (*e*). And *Nicander*
 “ observes, “ That serpents fly
 “ from even the smell of human
 “ spittle (*f*).

PLINY expresses the thing still in a stronger manner, and affirms,
 “ that there is in all men a poison,
 “ which kills serpents: and that
 “ these creatures run away from
 “ spittle, as they will from the
 “ touch of scalding water (*g*).

It may therefore justly seem strange, that, upon so good an authority as that of *Celsus*, (who ge-

(*e*) Histor. Animal. lib. viii. c. 29.

(*f*) Πολλάκι καὶ βροτέων σιάλων ὑποέτρεσαν
 ὁδμήν. Theriac. γ'. 86.

(*g*) Omnibus hominibus contra serpentes
 inest venenum, feruntque ictum salivae, ut
 ferventis aquae contactum, fugere. Loc.
 citat.

nerally gives us the methods of the *Greek* physicians and surgeons) so beneficial and easy a practice as this of the *Psylli* should not have been perpetuated by physicians. But the notion, that a poison so fatal in a wound, could not be taken into the mouth without hurt, was, no doubt, the obstacle : especially when it was imagined that outward applications would answer the purpose as well, without any hazard.

HOWEVER, this method of cure ought, I think, to be revived : and there happened, about three years ago in *London*, a very remarkable case, which confirms the success of it.

THE story is this, as related to me by an ingenious and experienced

rienced furgeon, who saw the case at the latter end of it. A man was bit on one of his fingers by a *Rattle-Snake*, just then brought over from *Virginia*. He immediately put his finger into his mouth, and sucked the wound. His under lip and tongue were presently swelled to a great degree: he faltered in his speech, and in some measure lost his senses. He then drank a large quantity of oil, and warm water upon it, by which he vomited plentifully. A live pigeon was cut in two, and applied to the finger. Two hours after this, the flesh about the wound was cut out, and the part burnt with a hot iron, and the arm embrocated with warm oil. He then recovered his speech and his senses. His arm continued swelled the next day, but by common

mon applications soon grew easy, and the patient suffered no farther mischief.

As the poison of this Snake is more quick and deadly than any other that we know; a remedy for this will most certainly prove effectual against that of smaller Vipers, and all other creatures of this kind. The other applications here made use of (the vomit excepted) could be of no service. The pigeon; the cutting and burning the part, two hours after the wound had been made; did no good. Embrocating the arm with oil only abated the swelling. Therefore the physicians of the Royal Academy at *Paris*, gave a right judgment of this application, in a like case. An account having been given in our Philosophical Transactions

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actions (*b*) of an experiment made, in which it was pretended that common oil, rubbed into the wound, had cured the bite of a Viper; they with all possible care made several trials with it, and pronounced it to be ineffectual; any farther than as it might be a fomentation to the tumefied part (*i*).

THE first thing then to be done upon the bite of a Viper, of any kind, is that the patient should immediately suck the wound himself, if he can come at it: if he cannot, another person should do this good office for him. Whoever does it, ought (to prevent any inflammation of the lips and tongue, from the heat of the poison) to wash his mouth well before-

(*b*) N^o. 443.

(*i*) Mem. Acad. Sc. Par. an. 1737.

hand with warm oil, and hold some of this in the mouth while the suction is performing.

AFTER this is over, it will be proper to give a vomit. A dose of *Rad. Ipecacuan.* encouraged in the working with oil and warm water, may be sufficient. The good effect of this is owing to the shake, which the action of vomiting gives to the nerves : whereby the irregular *spasms*, into which their whole system might be drawn, are prevented.

To confirm this practice, I have been assured by an ingenious surgeon who lived in *Virginia*, that the *Indians* there cure the bite of the *Rattle-Snake*, by sucking the wound, and taking immediately a large quantity of a decoction of the *Seneca Rattle-Snake Root*,

(which vomits plentifully) and laying to the part the same root chewed.

As to any other external management, I think it can avail but little: since it cannot prevent the sudden communication of the poison to the nerves. Burning the part with a hot iron is of no use. Dry salt upon the wound, recommended by *Celsus* (*k*), promises somewhat more, but not much. The celebrated snake-stones, brought from the *East-Indies*, and said to be taken out of the head of the *Cobra de Capello*, have no virtue to be depended on. This Signor *Redi* (*l*), Monsieur *Charas* (*m*), and my self have expe-

(*k*) Lib. v. c. 27.

(*l*) Esperienze intorno alle cose naturali.

(*m*) Pag. 66.

rienced.

rienced. They will indeed, when applied, stick to the wound for some time ; being, as appears from their make, not natural but factitious bodies, compounded most probably of calcined bones, and some testaceous substances mixt together: but when they drop off, are found to have imbibed nothing of the venom.

MORE is to be said for the remedy of our Viper-catchers, in which they place so much confidence, as to be no more afraid of a bite than of a common puncture ; immediately curing themselves by the application of their specific.

THIS, tho' they keep as a great secret, I have however upon strict inquiry found out to be no other than the *Axungia Viperina* presently

sently rubbed into the wound. And to convince my self of its good effects, I enraged a Viper to bite a young dog in the nose: both the teeth were struck deep in; he howled bitterly, and the part began to swell. I diligently applied some of the *Axungia* I had ready at hand, and he was very well the next day.

BUT because some gentlemen, who saw this experiment, were apt to impute the cure rather to the dog's spittle (he licking the wound) than to the virtue of the *fat*; we made him to be bit again in the tongue, forbearing the use of our remedy: and he died within four or five hours.

AT another time I made the like trial with the same success.

As

As this *Axungia* consists of clammy and viscid parts, which are withal more penetrating and active than most oily substances ; so these, without all doubt, may, if immediately applied, involve, and as it were sheath, the volatil salts of the venomous liquor, and thus prevent their shooting out into those crystalline *spicula*, which we have observed to be the main instruments of that deadly mischief that attends the bite.

BUT even this cure ought not to be relied on. 'Tis safest to use the method we have mentioned : and moreover, if the patient feels any sickness, faintness, or any of the nervous symptoms we have described ; he must be put into bed, and a sweat must be promoted by cordial medicines, particularly the
Confect.

Confect. Ralegh. and the salt of Vipers, or, in want of this, salt of Hartshorn, given in warm wine. I have often experienced the good effects of this proceeding: and, after all the pretensions of the cure by oil, in the case newly related (*n*), the man was really not recovered without these means.

I SHALL conclude with some hints, concerning the use of the Viper in phyfic: because authors are very large in enumerating its virtues against many, and those too, some of them, very obstinate distempers.

ONE of the first, whom we find in antiquity to have made use of the flesh of this creature to medicinal purposes, was, I think, *An-*

(*n*) Phil. Transact. N^o. 443.

tonius Musa, the famous phyfician to *Octavius Cæſar*; of whom *Pliny* (o) tells us, “ That when he met
“ with incurable ulcers, he or-
“ dered the eating of Vipers, and
“ by this means they were quickly
“ healed.”

It is not improbable that he might have learned this from the great *Greek* phyfician *Craterus*, mentioned often by *Cicero* in his epiftles to *Atticus*; who, as *Porphyrius* (p) relates, “ very happily
“ cured a miserable ſlave, whoſe
“ ſkin in a ſtrange manner fell off
“ from his bones, by adviſing him
“ to feed upon Vipers dreſſed after
“ the manner of fiſh.”

(o) Lib. xxx. c. 13.

(p) De abſtinent. ab animal. lib. i. p. 16.

BE this as it will, in *Galen's* time the profitable qualities of the Viper were very commonly known. He says, that they who are afflicted with the *Elephantiasis*, are wonderfully relieved by eating Vipers, dressed like eels: and relates very remarkable stories of cures of this disease, performed by the Viper wine (*q*).

ARETAEUS, who most probably lived about the same time with *Galen*, and of all the ancients has most accurately described the *Elephantiasis*, commends, as *Craterus* did, the eating of Vipers instead of fish in the same diseases (*r*). And to

(*q*) De arte curat. ad Glauc. lib. ii. c. 10. et De simpl. medic. facult. lib. xi. c. 1.

(*r*) Curat. diuturn. lib. ii. c. 13.

this purpose I remember, that as *Lopes* (s) in his relation of the kingdom of *Congo* in *Africa*, takes notice how greedily the Negroes eat Adders, roasting them, and esteeming them as the most delicious food; so *Dampier* (t) also informs us, that the natives of *Tonquin* in the *East Indies*, treat their friends with arack, in which Snakes and Scorpions have been infused, accounting this not only a great cordial, but also an antidote gainst the leprosy, and all other sorts of poison.

I HAVE since been told by a learned phyfician, who refided many years at *Bengal*, that it is a

(s) Vid. *Purchas. Pilgrims*, Part II. lib. vii. cap. 4. § 3.

(t) *Voyages*, Vol. II. Part I. p. 53.

constant practice there to order in diet the *Cobra de Capello*, (the Viper of that country) to persons wasted by long distempers.

THE physicians in *Italy* and *France* very commonly prescribe the broth and gelly of Vipers flesh for much the same uses, that is, to invigorate and purify the mass of blood exhausted with diseases, or tainted with some vicious and obstinate ferment.

FROM all this it appears, that the main efficacy of the viperine flesh is to quicken the circle of the blood, promote its due mixture, and by this means cleanse and scour the glands of those stagnating juices, which, turning to acidity, are the origin of many, at least, of those troublesome distempers in the surface of the body,

body, which go under the names of scrophulous, leprous, *etc.*

THESE good effects are owing to that penetrating, strong salt, with which the substance of these creatures does, in a very great proportion, abound; and the reason of this is from the food they live on, which we have observed before to be lizards, moles, *etc.* whose nature every one knows to be such as must necessarily, when they are dissolved in the stomach, supply the blood with a great quantity of active and volatil parts. And herein lies the difference between the flesh of Vipers, and that of other innocent serpents, which feeding chiefly upon grasse, herbs, *etc.* do not recommend themselves to us by any of those properties, which are in
so

so eminent a degree found in the former.

WHOSOEVER reflects on what has been said on this head, will very readily acknowledge, that our physicians deal too cautiously or sparingly with a remedy, which may be applied to very good purposes, when they prescribe a few grains of the powder of dried Vipers, or make up a small quantity of their flesh into *Troches*. Whereas, that service may really be done this way, the patient ought to eat frequently of Viper gelly, or broth; or rather, as the ancient manner was, to boil Vipers, and eat them like fish: if this food will not go down, (tho' really very good and delicious fare) to make use at least of wine, in which dried Vipers have been digested

gested two or three days, in a gentle heat (v), from which I have seen very good effects in obstinate *lepra's*; or lastly, (in some cases especially, where wine is not convenient) to take either the powder, or good quantities of the viperine salt, in which alone the virtue of all medicines made from this creature resides: And therefore the salt of any other animal, which is still more pungent and stimulating than this, (as is particularly that of *Cantharides*) is yet a more powerful remedy in dry and scaly *leprous* eruptions; which may without any inconvenience be given in the form of a *Tincture* made with spirit of wine (x).

(v) Vid. Pharmacop. Lond.

(x) Vid. eand. Pharmacop.

An APPENDIX,

CONTAINING

An anatomical description of those parts in a Viper, and in a Rattle-Snake, which are concerned in their Poison :

W I T H

A short ACCOUNT of some other venomous Animals.

IN order to give a full view of the instruments of death in a Viper, and that larger species of it, the Rattle-Snake, I shall explain the figures drawn from dissections of them both, beginning with the lesser animal, and ending with the bigger. And if some things are repeated in the latter, which had been observed in the former, this will

Tab: 1.

Fig. 1.

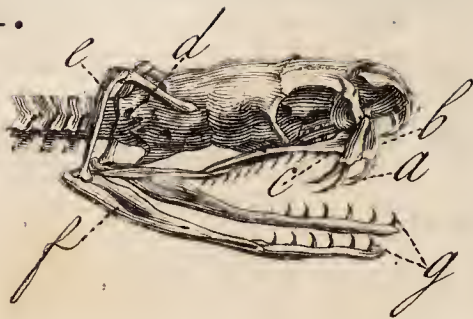


Fig. 7.



Fig: 2.



Fig. 3.



Fig. 8.

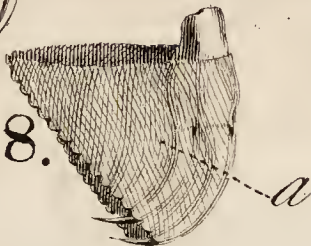


Fig. 4.

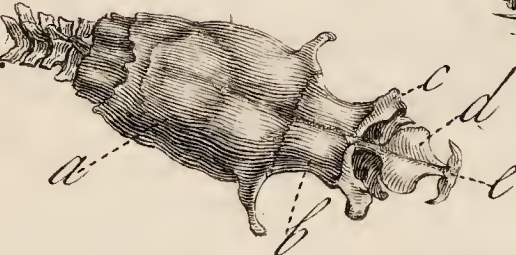


Fig. 9.



Fig. 5.



Fig. 6.

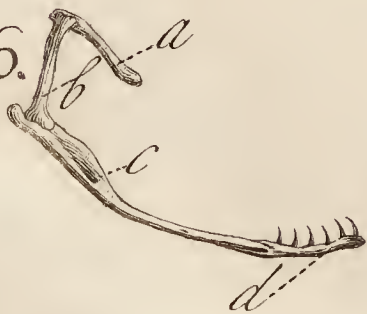
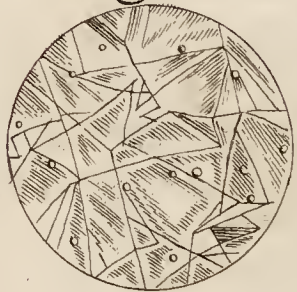


Fig. 10.



will not be thought tedious: because in subjects so minute, it is sometimes necessary to represent the same parts in different situations and connexions, that the uses assigned to them may be the more clearly understood. And for this reason, I shall not follow the order of the figures, so much as I shall the thread of the description, which they are designed to explain.

T A B L E I.

Exhibits several views taken from the head of the common Viper.

FIG. I. shews a side view of the skull and jaws; in which

a. REPRESENTS two poisoning fangs on each side, fixed (in a manner to be described hereafter) in a solid bone on each side *b.*

O

These

58 APPENDIX.

These solid bones are articulated by *ginglymus*, as it were pendent to the two *zygomata* : upon which, with the poisoning fangs, they receive two motions ; *viz.* production, by which the fangs are erected ; and retraction, by which these fangs are brought in, and couched against the roof of the mouth, so as to admit of closing the jaws.

FIG. 5. *a.* shews these fangs magnified.

THESE motions are produced by a thin slip of bone *c.* and Fig. 5. *d.* which being connected to the bone *b.* below its articulation, makes it to join in the motions of production and retraction, which it receives itself by being connected to the bone, Fig. 5. *c.* which is produced and retracted as well in conjunction with the under jaw,
to

to which it is connected, as by the action of muscles properly formed and subservient to itself.

FIG. 1. *f.* shews the under jaw, and

d, e. its two *fulcra*, by the help of which it receives variety of motions necessary in swallowing its prey.

FIG. 6. shews these two *fulcra* *a* and *b*, by the intervention of which the under jaw is connected to the *sinciput* and temporal bone.

IN order to understand the manner, by which the Viper swallows its prey, it must be observed, that the upper and lower jaw on one side move independently of the upper and lower jaw on the opposite side; so as that the upper and lower on one side can be protruded or retracted, while the cor-

O 2 respondent

respondent parts on the opposite side are either employed in contrary motions, or held firm and unmoved: and being furnished with small teeth firmly connected to their surfaces, which from their office we may term holders, Fig. 1. g. and Fig. 5. c. they are capable of drawing down their prey, by alternately retracting the two jaws on each side.

THESE holders are more numerous in the upper than in the lower jaw.

FIG. 5. c. shews them in the upper jaw.

FIG. 6. d. shews them in the lower.

FIG. 4. shews the top of the skull, in which

a. THE *sinciput* is composed of one bone, which in man is formed by

by the concurrence of the two parietal bones : whereas the *frons b*, which in man is one bone, is in this animal divided into two by a future.

c. SHEWS the anterior edges of the orbit of the eye formed by the frontal bone.

d. THE *ossa nasi*.

e. THE maxillary bone in this animal no way divided.

BEFORE we leave the bones of this part, we must observe, that the poisoning fangs are different from the holders in other circumstances, besides their magnitude and motions. And first I must remark, that, though there are two poisoning fangs on each side ; yet it rarely happens, that they are both firmly fixed in the sockets designed for their reception. I have observed sometimes, that the external

ternal fang on each fide was loofe, and fometimes the internal fang on each fide was loofe; and fometimes the internal on one fide, and the external on the other fide were loofe: and that, in protruding the fangs, that, which was firmly fixed, was more erected than that which was loofe; which it likewife always exceeded in length. From all thefe confiderations, joined to fome circumftances hereafter to be explained, I have been induced to believe, that the Viper employs but one fang at a time; nature having fo contrived, that the whole poifon prepared on one fide fhall as effectually be lodged in the prey by the action of one fang, as by both, and thus be fufficient to anfwer its purpofe.

As the fang of the Viper defcribes an arch of a circle in wounding

ing

ing its prey, so its force and strength are greatly secured by its curve form, resembling nearly the claw of a bird, Fig. 1. *a*, and Fig. 5. *a*. But as this form is necessarily attended with a great difficulty in disengaging it again from the part, into which it is struck; it must often happen, that its prey, in springing away on being wounded, must break off the fang: and the rather because the Viper, finding itself pulled away by the motions of its prey, will probably lash about its tail; till, fixing it self by it, the fang is obliged either to disengage it self, or to break off short at the socket, which is its weakest part. To remedy this inconvenience, the fang, which before was loose, probably soon becomes fixed; and the broken fang falling out, another new one is fixed (though loosely) in its place.

For,

For, to supply this loss or breaking of fangs, we always find a cluster of young fangs of different degrees of perfection, lodged in the bag near the roots of the poisoning fangs: of which I have counted six on one side in a Rattle-Snake. I shall not attempt to conjecture, by what means these subsidiary fangs are from time to time conducted to the empty sockets; the several circumstances mentioned being sufficient to incline us to believe, that they serve for that purpose: as the life of the animal manifestly requires such a supply for its preservation.

THESE poisoning fangs are hollow from near the edge of the socket to near the point. This hollow begins by an orifice in the fore part of the tooth, Fig. 2. *a.* and terminates at some distance above the

the *apex b*; from whence the fang is exceeding hard and solid, and sloped off, so as to resemble in some measure the common tooth-pick.

FIG. 3. represents this hollow of the tooth, by splitting it through its *axis*.

THE *apparatus* for preparing and injecting the poisonous fluid consists in a gland, Fig. 9. *c*. situated on each cheek: in which situation it is firmly connected to the *sinciput* at its commissure with the *occiput* by the ligament *a*, and to the posterior extremity of the lower jaw by the ligament *b*. From these ligaments continued on its surface the gland is furnished with a strong albugineous coat, proper to strengthen it against the great distensions, which it must
P suffer

suffer in accumulating its fluid, and the violent compressions in emitting it.

THE same integument continued on, forms the excretory duct *e*, by which the poison is conveyed from the gland into the cavity of the erected fang, by the assistance of a bag or purse, Fig. 7, and 8, *a*. in which the two poisoning fangs are on each side contained.

f. SHEWS a small white gland, which, from its situation near the fangs, has been supposed to be the organ for secreting the poison: though probably it is no more than either a lymphatic, or a salival, gland; and is entirely wanting in the Rattle-Snake.

ALL the muscles subservient to the action of biting are in this animal

nimal so situated, as to bear strongly upon the poison gland during their action; thereby conspiring to ejaculate its fluid.

BUT the chief part in this ejaculation of the poison is performed by the muscle *d*, which arising from the inferior *maxilla* runs obliquely upwards under the poison gland, till, passing between the two ligaments *a* and *b*, it reflects it self upon the external side of the gland, and running parallel with its length, is firmly attached to it. By the assistance of the ligament *a*, which in some measure serves as its tendon, this muscle must contribute to closing the jaws: but its greatest action is to squeeze the poison gland, which it nearly surrounds, in the same manner as we usually squeeze an orange, in order to express its juice. The disposition of

P 2

this

this muscle upon the surface of the gland in a continued course with the direction of its duct, and the terminating of this duct (which appears tendinous) at the roots of the fangs, were circumstances which raised an opinion, that this was altogether a muscle subservient to their retraction: The contrary of which will however appear by immersing the head, when excoriated, in hot water ; after which the muscle will easily separate, and leave the gland naked to view.

FIG. 7. shews the head of the Viper not dissected : in which

a. SHEWS the two poisoning fangs on each side inclosed in their proper bags, in which the different degrees of extension, or erection, are easily observed.

b. SHEWS

b. SHEWS the entrance into the *Trachea*, so situated as to be least liable to being comprefs'd in the action of swallowing.

c. SHEWS the tongue, by which the Viper laps the dew, and by whose action possibly the subsidiary fangs are placed in the empty sockets, as occasion may require.

FIG. 8. represents the bag enveloping the two fangs, as it appears when considerably magnified; whereby the fimbriated or scalloped edge is more distinguishable. But the particular structure and office of this bag will be better explained, by viewing it bigger in the *Rattle-Snake*.

TABLE II.

Shews five views taken from the head of an exceeding large *Rattle-Snake*: of which

FIG. I. *a.* represents the maxillary bone.

b. THE *ossa nasi*.

c. THE *os sphenoides*.

d. THE *os sincipitis*.

e. THE two *ossa frontis*.

f. THE *os temporum*, with the *os auditus* like that of birds, but standing nearly parallel to the spine.

g. THE *os occipitis*.

h. and *i.* THE two *fulcra* of the inferior *maxilla*.

k. THE bone, in whose sockets the two poisoning fangs are received, connected by *ginglymus* to

l. THE *zygoma*.

m, m.

Fig. 1.



Fig. 3.

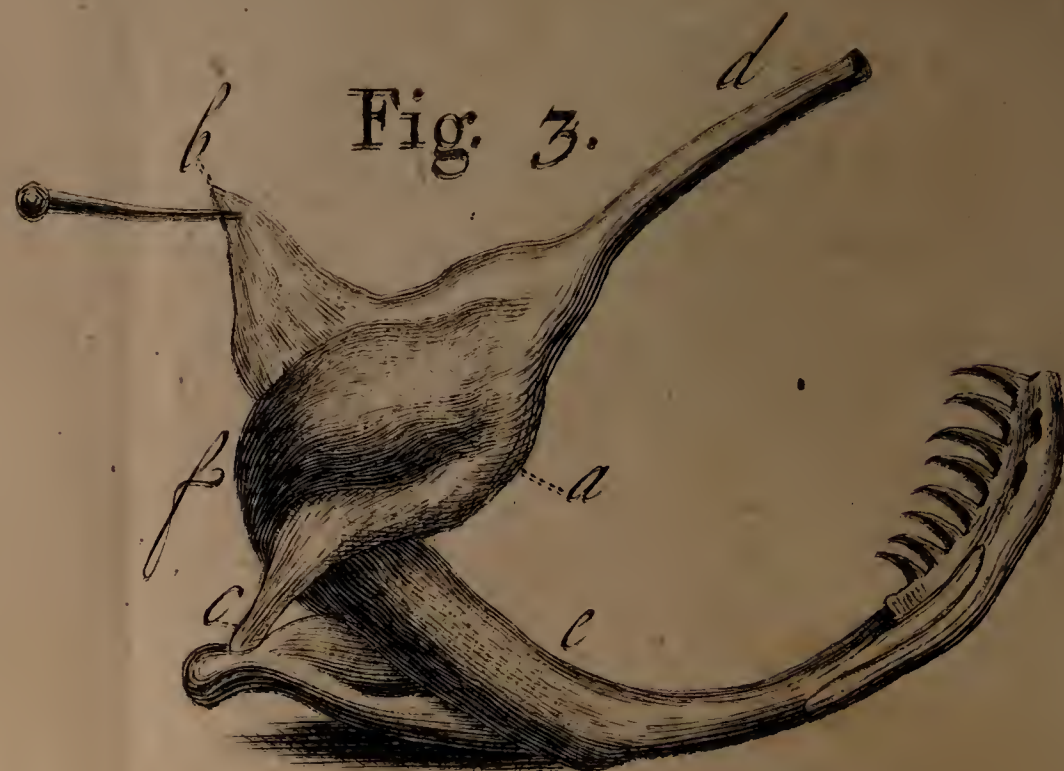


Fig. 5.



Fig. 2.



Fig. 4.



m, m. THE moveable bone of the upper jaw furnished with its holders; in which bone a joint may be observed at Fig. 2, *x.* at which joint it becomes curved, when

n. FIG. 1. a small splinter of bone, connected by one extremity to the former, and by the other to the bone containing the fangs, is so protruded, as to erect the fangs.

o. THE posterior extremity of the under jaw extended beyond its *fulcrum*, in order to increase the power of a small muscle serving to open it, Fig. 2. *g.*

p. SHEWS a process of the under jaw analogous to the *corone* in other animals, into which the great elevator is inserted.

BELOW this process externally may be observed a large *foramen*, *q.* by which the blood-vessels and nerves enter:

enter : which, after supplying branches to the *periosteum* and medullary substance, pass out again at a large internal *foramen*, *w.* Fig. 1. leaving some few twigs, which proceeding further pass out at two small *foramina*, *u.* and are spent upon the gums and under lip.

t, t. SHEW the holders in each jaw, which do not appear to be connected by a gomphotic articulation, but fixed by ligaments into shallow pits or inequalities designed for their reception.

r. SHEWS the poisoning fangs fixed in their sockets, as they appear when almost fully erected. For a supply of these fangs, when accidentally broke out,

s. SHEWS several subsidiary teeth of different magnitudes in their natural situation.

FIG. 2. Shews the same head, with its poison gland, and the several muscles subservient to the motions of the jaws, as they appear in their natural situation.

a. SHEWS a muscle, which, by being inserted behind its *fulcrum*, serves to open the under jaw.

b. A muscle inserted immediately before its *fulcrum*, serving to elevate or close the jaw.

BUT the most active muscle in closing the mouth and jaws seems to be *b, i.* which arising from the *os sincipitis*, and passing down behind the poison gland, is inserted into the under jaw at such a distance from its *fulcrum*, as to have the advantage of all the other muscles.

Q

d and e.

d and *e*. SHEW the two ligaments, by which the gland is fixed to the edge of the *sinciput* and the extremity of the under jaw.

l. SHEWS the body of the poison gland, covered by an albugineous coat formed by an expansion of the two ligaments mentioned.

THE same albugineous coat continued forms a large duct, *f*. by which the poisonous fluid is conveyed from the gland to the bag *c*. which envelops the poisoning fangs.

Now, although it has been observed, that the muscles *b*, and *b*, *i*. are so situated as to bear against the gland during their action, thereby assisting to expel the poison ; yet the greatest power in expelling the poison seems to be in the
the

the action of the muscle *k* ; which arising from the under jaw, and passing obliquely upwards behind, and in contact with, the poison gland, reflects itself forward between the two ligaments ; and, after extending itself over almost the whole gland, is firmly implanted into its fore and lower part: serving thereby both to compress and contract the whole gland, and so to expel its fluid.

FIG. 3. gives a more distinct view of this gland surrounded by its proper muscle.

a. SHEWS the poison gland.

b, and *c.* ITS two ligaments.

d. ITS duct.

e, and *f.* THE muscle surrounding it, which serves both to close the mouth in biting, or wounding

Q 2

its

its prey, and at the same time to expel the poison.

FROM this view it is obvious, why a less accurate examination (in so small an animal as a Viper, and whose muscles, being white, are therefore less distinguishable from other substances) might lead inquirers into an opinion, that the whole together was a muscle sending off a round tendon, and serving to draw the fangs inward.

FIG. 4. represents an under view of the same head, in which

a. SHEWS the superior orifice of the poisoning fangs in their retracted state.

b. THEIR inferior orifice.

c. SHEWS the fangs as covered by their bag, when in a retracted state: which bag is cut open on the

the opposite side, in order to shew the fangs. And

d. A fimbriated *septum* attached to the orifice of the poison duct, and dividing the fangs from each other.

e. SHEWS the poison gland, in whose duct two bristles are placed, which, passing into the *sacculus* at its summit, shew the entrance of the poison duct *f*, exactly between the superior orifices of the two fangs: through which orifices the bristles entering the fangs pass out at their slits.

FIG. 2. *c.* SHEWS this bag, whose edge is fimbriated, when stretched and expanded during the erected state of the fangs.

FROM this appearance it has been imagined, that the poison being discharged into the bag, and
 2 the

the bag being gradually pressed up to the summit of the fangs by the sides of the wound, as the fangs were impelled deeper and deeper, this pressure of the bag, acting upon its contained fluid, would be sufficient to force and direct the poison through the fangs into the bottom of the wound. But the loss of the fluid, which would partly escape at the gutter necessarily made by the contact of two cones, and (if their contact be not very close) between them too, with the waste of some, which would be left in the bag, have induced me to believe, that the immision of the poison into the wound depends on circumstances very different.

I HAVE been led to think, that, to lessen the inconvenience of breaking the fangs, one fang only, and on one side only, is erected at
 one

one bite, as I have before hinted; and that, by being erected, its superior orifice is brought nearly in contact with the orifice of the poison duct. And that, as the poison duct enters the bag exactly between the fangs, so the bag may serve to guide the duct to this or that side, according as this or that fang happens to be erected: thereby making the poison duct and the hollow of the fang one continued tube or canal.

IN order to this we need only to suppose, that the fimbriated *septum*, which divides the two fangs, is more elastic, or yields more easily, than the sides of the bag. In this case the fang by its erection stretching the bag, the *septum* being weakest will follow this stretch; and its extremity, to which the orifice of the poison duct is attached,

tached, be carried to this or that side, so as to meet this or that orifice, as the pressure or erection may happen to be in this or that fang.

FIG. 5. shews

A. THE part of the bag, which yields with the *septum* to the pressure of erection in the fang.

B, and C. THE sides of the bag, which admitting no stretch themselves, may throw the whole motion on the *septum* and the part A.

d, d. Two arches, of either of which any necessary part may be described by the motion of the orifice of the duct, in consequence of the *septum's* yielding more easily than the sides of the bag. The orifice of the duct thus changing its situation may be applied to the orifice of either of the fangs occasionally, and the whole poison prepared

pared by the gland be employed in the action of one single fang: the advantages of which to the Viper itself have been already explained.

FIG. 4. *g, h, i, k, l.* MUSCLES subservient to the motions of the jaws, whose actions sufficiently appear by their situations and directions.

To this most accurate description by Dr. *Nicholls*, I think it not amiss to subjoin a remark, concerning the use of the *Rattle* at the tail of this Snake, which has its name from it: because a vulgar error has obtained, even among the learned, about it.

It is commonly said, that this is a kind contrivance of divine Providence, to give warning to passen-

R

gers,

gers, by the noise which this part makes when the creature moves, to keep out of the way of its mischief. Now this is a mistake. It is beyond all dispute, that wisdom and goodness shine forth in all the works of the creation : but the contrivance here is of another kind than is imagined.

ALL the parts of animals are made either for the preservation of the individual, or for the propagation of its species : this before us is for the service of the individual. This Snake lives chiefly upon squirrels and birds, which a reptil can never catch without the advantage of some management to bring them within its reach. The way is this. The Snake creeps to the foot of a tree, and by shaking his *Rattle*, awakens the little creatures which are lodged in it : they are so

5

frighted

frighted at the sight of their enemy, who fixes his lively piercing eyes upon one or other of them, that they have no power to get away, but leap about from bough to bough, till they are quite tired; and at last falling to the ground, they are snapped into his mouth. This is by the people of the country called *charming* the squirrels and birds.

It must likewise be observed, that this Snake does not make any noise with its *Rattle* in the common motions of its body.

THERE is something like this in the lion's hunting for his food. The hungry tyrant, by his terrible roaring in the woods, rouses the lesser beasts out of their holes: they running about in fright and

surprize, are easily seized, and become a prey to his devouring jaws.

AND I have my self seen, upon a hawk's settling upon a tree in a garden, the little birds all about it so struck with fear, that though they could fly backwards and forwards, for some little distance, yet they have not been able to get away from the ravenous destroyer.

POISON-

POISONOUS ANIMALS.

AS the Viper is hurtful by instilling a liquid Poison into the wound made by its teeth; so likewise all venomous creatures whatsoever, whether they bite or sting, though there be some difference in the contrivance of their organs, are mischievous after much the same manner: and the most considerable of them for the same good use and purpose, that is, in order to kill their prey.

THIS will fully appear, by examining the instruments of death in several of them.

FIRST

FIRST then, the *Spider*, which lives upon flies, wasps, and the like insects, is provided with a hooked *forceps*, placed just by the mouth, very sharp and fine : with this he pierces the flesh of little creatures caught in his web, and at the same time infuses a juice into the puncture ; by which means the animal being killed, he sucks out the moisture from the body, and leaves it a dry husky carcase.

MR. *Van Leeuwenhoek*, in his account of Spiders, published in the Philosophical Transactions (*a*), has, together with the other parts, by the help of his glassess, described these weapons ; which he finds to lie couched on each side the

(*a*) N^o. 271.

mouth, in a row of teeth, till they are raised to do execution. These rows of small teeth are designed to hold the prey, that it may not escape the force of the bite. And in the convex part, towards the point of each claw, he has delineated a little aperture or slit, through which he supposes the poison issues out at the same time the wound is made.

THIS situation and motion of these parts I have several times viewed, but was never able to discern the outlet or opening; which, having a just deference to the industry and application of so nice an observer in things of this nature, I, at first, imputed to my own unskilfulness in such inquiries, knowing my microscope to be very good: till at last, after repeated trials, I very plainly saw, that
nothing

nothing dropt out of the claws, which were always dry while the spider bit; but that a short, white *Proboscis* was at the same time thrust out of the mouth, which instilled a liquor into the wound.

THEN I concluded, that Mr. *Leeuwenhoek* had delineated the apertures in these weapons, only from the analogy which he thought they must bear to the viperine fangs, the sting of the Scorpion, Bee, *etc.* And I was confirmed in this opinion by examining a claw of the great *American* spider, described by *Piso* (*b*), and called *Nhamdu*: which being above fifty times bigger than that of the largest *European* spider, if there had been any slit in it, my glass would, no

(*b*) Nat. Hist. lib. v. cap. 10.

doubt, have discovered it; but yet I found it to be quite solid.

AND indeed the quantity of liquor emitted by our common spiders, when they kill their prey, is visibly so great, and the wounding weapons so minute, that they could contain but a very inconsiderable portion thereof, if it were to be discharged that way.

To this purpose, I remember Mr. *Boyle* somewhere tells a story of a person blinded by a spider dropping its venom into his eye: which, though it can hardly find credit with some, is however confirmed by what *Piso* relates of his *Nhamdu*, viz. that in catching it great heed is to be taken, lest its poison fall into the eye, this causing a total loss of the sight.

WHAT Mr. *Leeuwenhoek* observes of the enmity these creatures bear to one another, I have often seen: for if four, five, or more be put together into a glass, they immediately fall to fighting with all the fury imaginable. Limbs struck off are usually the preludes to the terrible slaughter, which continues till all are killed, the surviving conqueror himself most commonly dying of his wounds.

THE weapons of mischief in the *Scolopendra*, or *Centipes*, are somewhat different from those in the spider. Having had one of these creatures sent to me, preserved in spirit of wine, from the *East Indies*, (where they are very large, and their bite is so painful, that, as *Bontius* says, it makes the patient almost mad) I examined the claws
of

of its *forceps* by a microscope; and in each of them observed a small aperture, on the upper side near the point (*c*). And Mr. *Leeuwenhoek* (*d*), who had one of the same kind alive, found, that by pressing the claw, a small drop of liquor issued out of this hole.

THE case is much the same with stinging animals. Of these the *Scorpion* (*e*) is the chief, whose *virus* in different countries is more or less dangerous, according as 'tis exalted by various degrees of heat: thus in *Africa* particularly, its effects are so dreadful, that, as *Joan. Leo* (*f*) tells us, the town of *Pes-*

(*c*) Vid. Tab. iii. Fig. 1 et 2.

(*d*) Continuatio Arcanor. Natur. Epist. 124.

(*e*) Tab. iii. Fig. 3.

(*f*) Histor. Afric. lib. vi.

cara there, is in a manner left desolate by the inhabitants in the summer time, by reason of the great abundance of these creatures; certain death following their sting.

SEVERAL of this kind *Signor Redi* (g) at *Florence*, had sent to him from *Tunis*; and, it being November, irritated them to sting pigeons, pullets, *etc.* without any bad effect at all: but upon the approaching spring, one of them, which had been kept all the winter, nay eight months, without any food, and the wound of whose sting before was harmless, stung to death two pigeons successively; but a third and fourth wounded in like manner, suffered no hurt. Yet having let the Scorpion rest all

(g) *Generazione degli Insetti*, pag. 15.

night, he killed another pigeon the next morning.

AT the point of the sting he very often could discern a small drop of white liquor, which, when the wound was made, entered into the flesh.

As this liquid venom is either not separated from the blood into the cavity of the sting, during the cold of winter, or at least the Scorpion wants strength at that time to throw it out with force and energy: so even in the hot months, after it is exhausted by two or three attacks, the sting is no longer hurtful, till the expence of this juice is recruited by time.

VIEWING the sting of one of these animals brought from the *East Indies*, (where they are much bigger

bigger than in *Africa*) I could, with a glass, easily discover a long slit, on each side of it, near to the *cusps*, which is exactly delineated by Mr. *Leeuwenhoeck* (*b*), who also saw the venom drop out of it (*i*).

It is very remarkable concerning this insect, what an ingenious gentleman, who lived several years in *Barbary*, told me, he had many times tried; that if it be surrounded with a circle of burning coals, it does, upon the sense of the heat, turn it self violently every way to make an escape; but finding it impossible, and the pain from the fire increasing, it strikes it self twice or thrice with the sting on the back, and immediately dies of the wounds.

(*b*) Lib. citat. epist. 123.

(*i*) Vid. Tab. iii. fig. 4.

THE fact has since been confirmed to me by others, who have assured me, that it is a common diversion among the soldiers at *Gibraltar* (where these creatures abound) to make this experiment.

THIS self-murder decides the controversy among writers, whether poisonous animals of the same species can kill each other. Which is not only confirmed by what we before observed of the spider, but is likewise true of *Vipers*: for Dr. *Herman* bringing from the *Indies* three of the *Cobras de Capello* all in one glass, two of them were killed in the voyage by fighting. And the learned *Jo. Rhodius* at *Padua* observed, that two *Scorpions* being put into a glass, they fought, and one having killed the other, devoured it (*k*).

(*k*) Not. ad Scribon. Larg. Pag. 244.

As the viperine venom is the quintessence and most active part of those animal juices, with which the Viper is nourished, so is also that of the Scorpion: for this insect lives chiefly upon locusts, *etc.* and the same person from *Barbary* informed me, that seeing oftentimes locusts sticking up in the ground, as if they were set there, by looking he found that some part of them was always eat away; and that these places were the holes of Scorpions, who had dragged their prey thither, and fed on it as they had occasion.

THE mechanism of the sting of a Bee Dr. *Hooke* has very accurately described (*l*). One may with the naked eye sometimes see it discharge the venom; and in

(*l*) Micrograph. Observ. 34.

this, by the help of a glass, I can easily discover a great number of minute salts floating.

AND indeed this *apparatus* or contrivance is so universal, that we find even in vegetables something analogous hereunto: for the last mentioned author (*m*) has shewn us, that the pricking points of Nettles do, at the same time they pierce the skin, instil a venomous juice into the wound.

As the bites and stings, not only of these Insects we have mentioned, but also of several others, as Hornets, Wasps, Gnats, *etc.* are often very troublesome, and attended with more pain, inflammation and swelling, than would be expected from such little enemies;

(*m*) Micrograph. Obs. 25.

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I shall conclude with observing, that the common cure in all accidents of this kind, will be, (as in the bite of a Viper) by immediately sucking out with the mouth the instilled poisonous drop, and applying to the wound a pultice of bread and milk: but if this has been neglected, the part must be fomented with warm oil and soft discutient ointments.

ESSAY

ESSAY II.

Of the TARANTULA.

THE Symptoms from the bite of the *Tarantula* are so very odd and surprizing, that the truth of the facts has by some been called in question. There is reason for this suspicion, because the mischief commonly happens to poor people; who, as they often receive charity upon it, may be tempted to dissemble, and to act a part, as if they suffered what they really have not. And besides this, hysterical affections (as we shall ob-

serve by and by) are in this country sometimes attended with the same appearances: so that it is hard to distinguish one case from the other.

HOWEVER, though there are here many deceits and impostures, yet even these, I think, are an evidence to prove the point: since it cannot be supposed, that a disease would be counterfeited, which had never any foundation in nature.

NEITHER can I be persuaded, that *Baglivi*, a native of the country, and learned physician, (who must have known that tricks were played in this way) would have taken the pains to write a long Dissertation on this subject (*a*), had he not been tho-

(*a*) Vid: Baglivi De Praxi Medica, et Dissertationes, Romae, 1696.

roughly convinced of the reality of such a Poison.

BESIDES this, after *Baglivi's* book was published, *Ludovicus Valetta*, a *Celestine* monk of *Apulia*, put out at *Naples* a treatise upon this Spider (*b*); in which he not only answers the objections of those, who deny the whole thing, but gives from his own knowledge several instances of persons, who had suffered this way: some of whom were of great families, and so far from being dissemblers, that they would at any rate, to avoid shame, have concealed the misfortune, which had befallen them.

To these may be added the testimony of the Hon. Mr. *Boyle*,

(*b*) De Phalangio Apulo opusculum, Neapoli, 1706.

who

who assures us, that having himself had some doubts about this matter, he was, after strict inquiry, convinced that the relations in the main were true (c).

I SHALL therefore, from the authentic accounts given by the two mentioned authors, extract what is most material and necessary to our present purpose.

THE *Tarantula* (d) is a *Spider* of *Apulia*, of the octonocular kind; that is, of that species that has eight eyes, and spins webbs. It has eight legs, four on each side, and in each leg three joints. From the mouth proceed two darts, in shape just like to a hooked *forceps*, or

(c) Of languid and unheeded motions, cap. vi.

(d) Tab. iii. fig. 5.

crab's claws: these are solid, and very sharp, so that they can easily pierce the skin. And between these and the fore-legs there are two little horns, which I suppose answer to those bodies called from their use in Flies the Feelers: because as they do, so this creature is observed to move them very briskly, when it approaches to its prey.

THIS, as other Spiders do, propagates its species by laying eggs, which are very numerous; so that there are found sometimes in the female, when dissected, a hundred or more: and these are hatched partly by the heat of the mother, partly by that of the sun, in about twenty or thirty days time.

THERE is also a Spider of the like nature with the *Tarantula* in
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the *West-Indies*, which *Fr. Hernandez* (*e*) describes by the name of *Hoitztocatl*, or the *Pricking Spider*; and says, that its bite induces madness.

IN the summer months, especially when the heats are greatest, as in the Dog-days, the *Tarantula* creeping among the corn in the fields, bites the mowers and passengers: in the winter it lurks in holes, and is scarcely seen; and if it does bite then, it is not venomous, neither does it induce any ill symptoms.

BUT in the hot weather, although the pain of its bite is at first no greater than what is caused by the sting of a Bee; yet the part

(*e*) *Histor. Animal. Nov. Hispan. Tract. iv. cap. 5.*

quickly

quickly after is discoloured with a livid, black, or yellowish circle, and raised to an inflamed swelling. The patient within a few hours is seized with a violent sickness, difficulty of breathing, universal faintness, and sometimes trembling, with a weakness of the head: being asked what the ail is, makes no reply, or with a querulous voice, and melancholy look, points to his breast, as if the heart was most affected.

DURING this mournful scene, all the usual *Alexipharmac* and *Cordial* medicines are of no service: for notwithstanding their repeated use, the patient growing by degrees more melancholy, stupid, and strangely timorous, in a short time expires; unless *Music* be called to his assistance, which alone, with-

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out the help of medicine, performs the cure.

FOR at the first sound of the musical instrument, although the sick lie, as it were, in an apoplectic fit, they begin by degrees to move their hands and feet; till at last they get up, and fall to dancing with wonderful vigour, at first for three or four hours: then they are put to bed, refreshed from their sweating, for a short time, and repeat the exercise with the same vehemence; perceiving no weariness or weakness from it, but professing they grow stronger and nimbler, the more they dance.

AT this sport they usually spend twelve hours a day, and it continues three or four days; by which time they are generally freed from
all

all their symptoms, which nevertheless attack them again about the same time the next year: and if they do not take care to prevent this relapse by music, they fall into a jaundice, want of appetite, universal weakness, and such like diseases; which are every year increased, if dancing be neglected, till at last they prove incurable.

As music is the common cure, so they, who are bitten, are pleased, some with one sort of it, some with another. One is raised with a pipe, another with a timbrel; one with a harp, another with a fiddle; so that the musicians make sometimes several essays, before they can accommodate their art to the venom: but this is constant and certain, notwithstanding this variety, that they all require the quickest and briskest tunes, and

are never moved by a flow, dull harmony.

WHILE the *Tarantati*, or affected, are dancing, they lose in a manner the use of all their senses, like so many drunkards, do many ridiculous and foolish tricks, talk and act obscenely and rudely, take great pleasure in playing with vine leaves, with naked swords, red cloths, and the like; and on the other hand can't bear the sight of any thing black: so that if any by-stander happen to appear in that colour, he must immediately withdraw, otherwise they relapse into their symptoms with as much violence as ever.

It may afford some light towards understanding the nature of this poison, to observe that *Apulia* is the hottest part of all *Italy*, lying east-

eastward, and having all the summer long but very little rain to temper the heats: so that the inhabitants breath an air, as it were, out of a firey furnace. Hence their temperament is dry and aduſt, as appears by their being generally lean, paſſionate, impatient, ready to action, quick-witted, very ſubject to inflammatory diſtempers, phrenſies, melancholy, and the like : upon which account there are more mad people in this, than in all the other parts of *Italy*. Nay, what in other countries is but a light melancholy, ariſes here to a great highth : for women in a *Chlorosis* ſuffer almoſt the ſame ſymptoms as perſons poiſoned by the *Tarantula* do, and are cured the ſame way ; and in like manner the venom of the Scorpion does here in effects and cure agree very much with that of this Spider.

FROM

FROM all this history it sufficiently appears, that those that are bitten by a *Tarantula*, do thereupon become delirious. In order therefore to account for the symptoms they suffer, it may not be improper to say something concerning a *Delirium*.

SUCH is the constitution of the human oeconomy, that as upon the impression of outward objects made upon the organs, and by the fluid of the nerves conveyed to the common sensory, different *species* are excited there, and represented to the mind; so likewise upon this representation, at the command of the mind, part of the same fluid is determined into the muscles, and, together with the arterial blood there, performs all the variety of voluntary motions and actions.

THIS

THIS order has been always so constant in us, that at length by a kind of natural habitude, without the intervention of the reasoning faculty, representations made to the mind immediately and necessarily produce suitable motions in the bodily organs. When therefore these representations are irregular, the actions consequent to them must necessarily be so too.

THIS being premised, it may perhaps be probably said, that a *Delirium* is the representation and various composition of several *species* to the mind, without any order or coherence; together, at least most commonly, with irregular, or, as it were, undesigned motions of the body: that is, such a wandering and irregular motion of the nervous fluid, whereby several

veral objects are represented to the mind, and upon this representation divers operations performed by the body, though those objects are not impressed upon the organs, nor those operations or motions, deliberately commanded by the soul.

THE mind indeed is the first principle of all muscular motion: but in such cases as these, its promptitude to action or habit being so great, it is in a manner surprized, and cannot recover it self, after the spirits are with violent force determined pursuant to the representation of the *species*. For, as in the former state of things, a man is said to act rationally, so this latter case is called a Perturbation of Mind, that is, a *Delirium*; though it is very manifest, that in reality the defect is not in the rational, but corporeal part: such
species

Species being really presented to the mind, upon which by the order of our constitution such motions ought to follow in the body.

THUS, for instance, if the liquor of the nerves is, without the presence of any thing hurtful, put into a motion like unto that, which a painful impression makes in it; the same bodily actions must insue, as proceed from fear, anger, or the like passion, determining the spirits towards the muscular parts. And a by-stander, who sees no reason for such a representation made to the mind, will presently conclude, that the person thus acting acts without or besides his reason, that is, is delirious; especially if the hurry and confusion of the spirits be such, that not only one, but several different *species* be at

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the

the same time presented to the mind: for a man in this case may act the part of one joyful, angry, timorous, or the like, without any appearing reason, and all this almost in the same moment of time.

IN one word, *Deliria* are the dreams of those who are awake. And as these in us sleeping are infinitely various and wonderfully compounded, and all from the same common cause, diversely pressing the orifices of the nerves, and thus making different repercussions of their fluid; and as we all know that, in this confusion of representations to the mind, there hereupon follow (though the body seem now in perfect repose) such motions in the organs, as are usually the effect of the arbitrary determination of the spirits thither: so we are now to inquire,

quire, what alteration of the body, made by this venom, can be the occasion of this disorder and tumult in the nervous fluid, which excites in the party infected such surprizing, and almost contradictory representations.

MOST of the symptoms of those, who are bitten by the *Tarantula*, are at the first, that is, before they rise to a *delirium*, plainly the same with those which the bite of a Viper induces: without doubt therefore, as we have before observed of the common Spider, that it pierces the flesh with its hooked *forceps*, and at the same time instils from the *Proboscis* in the mouth a liquid venom into the wound; so the like claws in this (*f*) serve to make way for an active

(*f*) Vid. Tab. iii. fig. 5.

and penetrating juice emitted from the same part.

THIS fiery drop (as in the case of other poisonous animals) puts the nervous liquor into a ferment. A fever insues: The secretion of this fluid in the brain, and consequently its derivation into the organs, is irregular: The impressions of outward objects upon the spirits so inflamed affect too sensibly; nay, without the action of these, in such a disturbed state of the oeconomy, species or images are presented to the mind, which produce suitable, that is, irregular motions in the body.

MORE will be said to this purpose in the following Essay. For the present it may suffice to observe, that these representations and actions will generally be according to

to the temperament of the patient; and the spirits will be hurried to those parts, to which in time of health they have been most frequently determined: and every one knows which these are in hot countries and constitutions.

It will perhaps make this theory probable, to consider that *Baglivi* (g), in the dissection of a Rabbit, killed by a *Tarantula*, found the substance of the brain, near the origin of the nerves, lightly inflamed, with livid spots here and there; a large quantity of extravasated *serum* upon the brain: the effect generally of the circulation of the blood stopped by a fault in the secretion of the nervous liquor.

(g) Pag. 40.

As to the cure, which seems almost ridiculous, we must take notice, that the patients have no inclination to dance, till they hear the music: being desired to do it, they answer, it is impossible, they have no strength. Their starting up therefore, at the first noise of the instrument, is of a piece with their other actions: as every thing from without has too great an effect on the nerves and their disordered fluid, so sounds, which formerly were joined to this exercise, and encouraged it, now excite to it with fury and violence. And the benefit of it is, that the continued motions of the limbs produce large sweats, which by carrying off the inflammatory particles, abate the fever raised in the animal spirits.

BUT

BUT besides this, we may perhaps allow somewhat to the determinate force and particular modulation of the trembling percussions of the air, made by the musical chords upon the elastic fibres in the brain: for contractil bodies may be acted upon by one certain degree of motion in the ambient fluid, though a greater degree of it, differently modified, may produce nothing of the like effect. This we see in the common experiment of two musical instruments, tuned both to the same pitch: the strings of the one being struck, the correspondent strings of the other will sound; and yet a much greater motion of the air, otherwise agitated, will not cause any sensible vibration in the same chords: And also by a trick which some have, of finding the tone or note peculiarly

liarily belonging to any large wine-glass, and by adapting their voice exactly to that tone, and making it loud and lasting, they will make the vessel, first to tremble, and then burst ; which it will not do, if their voice be but a little either too low or too high (*b*).

MR. *Boyle* relates a story, from *Scaliger*, of a knight of *Gascony*, whom the sound of a bag-pipe would unavoidably force to make water ; though this secretion is regularly made by the arbitrary contraction of the muscle of the bladder (*i*).

THIS makes it no difficult matter to conceive the reason, why

(*b*) Vid. *Morhofii Stentor* ΤΑΛΟΚΛΑΣΤΗΣ. *Kilon*. 1682.

(*i*) Of languid and unheeded motions, cap. vi.

different persons infected with this venom, require often for their cure a different kind of music: their fibres having different tensions, are not in like manner acted upon by the same vibrations.

THE obstinate continuing of the patients in this exercise is, in a great measure, owing to the encouragement of the by-standers, and the strong opinion they have of being benefited by it.

NOR are we to wonder at this practice, as odd and irrational: for *Music* was anciently very much made use of to medicinal purposes; and may, without doubt, do very great service, even by a mechanical force, in many bad distempers; particularly in some disorders of the mind, which being always attended with irregular hurries

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of the spirits, may be quieted by exciting in them such motions as accompany the contrary passions.

It is plain from the history of king *Saul*, that this was known in very early days among the *Jews*. He being at times seized with fits of madness, was cured this way (*k*): for the *evil spirit from the Lord*, I suppose (according to the *Jewish* manner of expressing extraordinary incidents) means no more than a *maniacal fury*, which, by divine judgment, he at certain times fell into.

WE have a famous testimony to this purpose in *Galen* (*l*), who tells us, “that *Aesculapius* used to
“ recover those, in whom violent

(*k*) 1 Samuel, cap. xvi.

(*l*) De Sanit. tuenda, lib 1. cap. viii.

“ motions

“ motions of the mind had in-
 “ duced a hot temperament of
 “ body, by melody and songs.”

Pindar (*m*) mentions the same thing : and indeed from hence not only the notion, but the very name of charming (*n*) seems to have taken its origin. *Athenæus* (*o*) relates, that *Theophrastus*, in his book of *Enthusiasm*, says, “ *Ischi-*
 “ *adic* pains are cured by the
 “ *Phrygian* harmony.” This sort of music was upon a pipe, and the most vehement and brisk of all the antients knew ; so that indeed it was said to raise those, who heard it, to downright fury and madness (*p*) : and such we have observed to be required to the venom of the *Tarantula*.

(*m*) *Pythior. Od. 3. μαλακαῖς ἐπασιδαῖς.*
 Vid. *ibid. Scholia.*

(*n*) A Carmine.

(*o*) *Deipnosoph. l. xiv. p. 624.*

(*p*) Vid. *Bartholin. De tibiis veter. l. i. c. 9.*

BUT what is besides in this last authority very observable to our purpose, is the manner of using this remedy, and that was (q) “by
 “playing upon the part affected;” which confirms what we have just now advanced concerning the effect of the percussion of the air upon the contractil fibres of the brain: for piping upon any member of the body cannot be supposed to do service any other way, than by such succussions and modulated vibrations as we before mentioned. And this indeed *Caelius Aurelianus* (r) agrees to, who calls this practice, *decantare loca dolentia*; and says, that “the pain is mitigated and

(q) Εἰ καταυλήσῃ τις τῷ τόπῳ τῇ Φρυγίτι ἀρμονίᾳ.

(r) Morb. chronic. l. v. c. i. Quae cum saltum fumerent palpitando, discussio dolore mitescerent.

“ disscussed by the tremblings and
“ palpitations of the part.”

Anlus Gellius (*s*) not only relates this same cure of *Ischiadic* ails as a thing notorious enough, but adds besides out of *Theophrastus*, “ that
“ the music of a pipe rightly managed healed the bites of Vipers.”

AND not only does *Apollonius* (*t*) mention the cure of distractions of the mind, epilepsies, and several other distempers this same way; but *Democritus* (*u*) in his treatise of Plagues taught, “ that
“ the music of pipes was the medicine for many diseases;” which

(*s*) Noct. Atticar. l. iv. c. 13.

(*t*) Histor. Mirabil.

(*u*) Apud Aul. Gell. loc. citat. Plurimis hominum morbis medicinam fuisse inentionem tibi arum.

Thales of Crete confirmed by his practice: when sent for by the *Lacedaemonians* to remove from them the pestilence, he did it by the help of music (x).

ALL which instances evince this remedy to have been very ancient in many cases. And indeed as *Caelius Aurelianus* (y) takes notice, that the first use of it was ascribed to *Pythagoras* himself, so he having settled and founded his sect in those very parts of *Italy*, which are the country of the *Tarantulae*, going then under the name of *Graecia magna*, now *Calabria*; it is not, I think, at all improbable, that he may have been the author and inventor of this practice there, which has continued ever since:

(x) Plutarc. de Musica.

(y) Loc. ante cit.

especially since *Jamblichus* affirms (z), not only that he made use of music in physic, but particularly that he found out and contrived some harmonies to ease the passions of the mind, and others for the cure of bites.

To this useful power of Music I will (to confirm my reasonings upon it) add a remarkable instance of its hurtful effects, even in a brute; which an ingenious gentleman told me he once saw. A player on a fiddle having frequently observed, that a dog in the room was always so affected by a particular note, as to howl, and shew great uneasiness at it; one day, for experiment's sake, continued to strike the same note so long, till the

(z) De Vit. Pythagor. cap. 25. πρὸς διγ-
μὲς ἑοιθηλικάλα μέλη.

sensible animal fell into convulsions and died.

To conclude with the *Tarantula*, we may take notice, that, as to the return of the symptoms the next year, that is owing to the same excessive heat in those months, acting again upon the small remains of the venomous ferment. Thus *Bartholin* (a) relates a story of a melancholy physician at *Venice*, who suffered the attacks of his disease only during the dog-days, which yearly ended and returned with them: a convincing proof how great a share heat has in all these cases.

(a) *Histor. Anatom.* Cent. 2. H. 26.

ESSAY III.

Of the MAD DOG.

THE terrible effects of the *Poison* from the bite of a *Mad Dog* appear after so different a manner in different subjects, that the accounts given of them by authors, being generally taken from single cases, are very different, and hardly consistent with one another. The main symptom indeed they all agree in, that is, what they call (though improperly) the *Hydrophobia*, or *Dread of Water* : but the disorders, with which this is

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attended, are related so variously, that they can scarcely be thought to belong to the same kind of malady.

I SHALL therefore first describe the history of this disease, from observations made on a considerable number of patients : and then inquire into the reasons, why the fatal distemper commonly produced by it shews it self with so much variety, and appears, as it were, disguised in some cases.

THE wound from the bite of a mad dog differs not at all from that made by a common bite, and is as easily healed : and it is a considerable time before any bad consequences of it appear. There are instances where these have been deferred to two, three, or six months ; nay, some authors say, to a year and

and longer. *Galen* himself saw one case after a year (*a*); I remember one after eleven months: but the attack is generally within thirty or forty days, though very often sooner, sometimes in fifteen or sixteen days, in young subjects.

THE first approaches of the distemper generally discover themselves after this manner. A pain is felt in the part which was wounded, which by degrees spreads it self to the neighbouring parts: a lassitude follows with uneasiness in all the limbs. Then the patient grows pensive and sad, with disturbed and unquiet sleeps, complains of faintness and lowness of spirits, particularly of an oppression at his breast. His pulse

(*a*) Comment. ii. in 1 Prorrhēt. Hippocrat.

intermits, his nerves tremble, he has cold sweats, a great *nausea* and sickness at stomach, and loaths food : and though he has an inward heat and thirst, and desires to drink ; yet he swallows meat, but especially liquors, with great difficulty. These symptoms increase, and the next day, from the great uneasiness and pain, which he finds in swallowing, he conceives such an aversion to liquids, that at the first sight of them he falls into convulsions and agonies, and cannot get down the least drop. This *Hydrophobia* has always been accounted the surest sign and mark of this Poison, by which it is distinguished from all other diseases ; as not being observed, at least very rarely, in any other case whatsoever.

AT this time a fever usually appears, with a quick but low pulse, without the least sleep, a hoarse voice, a gathering of froth in the mouth, and spitting out of this upon the by-standers; universal convulsions, particularly about the throat, and in the *Musculi erectores penis*, whence a continued *priapism* is observed. During this tragical scene, which always proves fatal in about two days, a *delirium* comes on, sometimes with most terrible symptoms of rage and fury, and attempts of doing all possible mischief even to the most beloved friends and relations; but more commonly without any *furor*, it is of the *melancholy* kind, and the wretch resigns to death, and prepares for it, bids those about him take care of themselves, lest he should do them mischief;

mischief; and begs that they would trouble him no more : and, his breath growing shorter and shorter, expires in convulsive fits.

MANY of the ancients have mentioned this disease, particularly *Dioscorides*, *Galen*, *Aetius*, *Aegineta* : but none have described it so largely as *Caelius Aurelianus* (*b*), who, from the writings of the *Greek* physicians, (chiefly *Soranus*, of the methodic sect) has collected, and put into obscure bad *Latin*, all the symptoms of it, with great pains and exactness. The names of the more modern authors on this subject may be seen collected by that diligent observer, *Stalpart Vander Wiel* (*c*), to which may be added the learned Dr. *Lister* (*d*).

(*b*) De morbis acutis, lib. iii.

(*c*) Observat. Rarior. Cent. i. Obs. 100.

(*d*) Exercit. Medicinal.

IT will afford great light towards the knowledge of the nature of this abstruse disease, to remark some odd appearances in the progress of it: which, though with a little variety, discover themselves in a greater or lesser degree in all the unhappy patients.

IT is common to them all, that they can ill bear the impression of objects upon the senses. All feeling is painful. The slightest touch or rubbing of the limbs hurts. The least noise is offensive: and the opening or shutting of a door affrights, as if the house was falling. The eyes so ill bear the light, that even the sight of any thing white is intolerable. In like manner, the inward membranes are so tender, that they cannot suffer their natural sensation. The common
coolness

coolness of fresh air is disagreeable to the lungs: and the making of water gives uneasiness and grief in the urinary passages. The aspect is dismal, either frightful with tokens of rage and fury, or lamentable with marks of moaning and despair. There is no sleep from the beginning of the fever to the end.

WHEN the symptoms are *maniacal*, the strength of the muscles is prodigious: these acting indeed with a convulsive force so great, that I have seen a case, in which a man tied down in bed with strong cords broke them all at once by one effort, and immediately died paralytic; as if all the fibres of the body had been overstrained and torn to pieces by their violent action.

As to the *Hydrophobia*, the patient at first has no dread of water, nor any aversion to liquors. On the contrary, he sees them with pleasure: being thirsty he desires to drink; but then soon wonders, what should be the reason that he is not able to take it. He contrives ways to do it, by endeavouring to suck through a quill, *etc.* but soon cries out: it is impossible. When asked why, he answers: it will not go down, it strangles him, and begs to be excused trying any more.

IN order to find out the cause of this train of dreadful events, we must take notice, that the *rabies* or madness in a dog is the effect of a violent fever: and therefore it is most common in excessive hot weather, though sometimes intense
A a cold

cold may be the cause of it. That no dog ever sweats: from whence it follows, that when his blood is in a ferment, it cannot, as in other creatures, discharge itself upon the surface of the body; and therefore must of necessity throw out a great many saline and active particles upon those parts, where there is the most constant and easy secretion: and such, next to the *milary* in the skin in us, are the *salival* glands. For this reason much more spittle is separated in a dog, when mad, than at any other time, and that very frothy, or impregnated with hot subtile parts.

THE looks of a dog in this condition discover a fever. He runs wildly forward panting, snaps at every one he meets: his tongue hangs out of his mouth with flabber: his eyes are heavy, full of
tears:

tears: he takes no food nor drink. In dissecting one, who died mad, the forepart of the *dura mater* on the brain, about an inch above the eye-brows, was found inflamed and even ulcerated, the ulcerations piercing through this membrane, and also the *pia mater*: and upon pressure there issued out from the small ulcers a thin matter tinged with blood.

Now as we every day observe, that what is thrown out from liquors in a ferment, is capable of inducing the like motion in another liquor of the same kind, when duly mixed with it; so we may very well suppose in the present case, that the *saliva*, which is itself one of the most fermentative juices in nature, being turgid with firey saline particles thrown into it out of the boiling blood, when it

comes by means of a wound to be mixed with the nervous liquor in another animal, it must necessarily put it into violent agitations, in the nature of a ferment, (as has been explained in the Introduction :) the consequence of which will be all the effects of an interrupted secretion in the brain, and disturbed circulation of the blood, fever with *delirium*, convulsions, *etc.*

THAT this *delirium* is sometimes *maniacal*, sometimes *melancholic*, is owing to the different temperament and constitution of the patient, inclined more to passions of one kind or the other. As we see the effects of drunkenness are in one man good humour, mirth, and joy ; in another, ill-nature, malice, and rage ; in a third, a mixture of ridiculous and extravagant actions: and all from the
same

same common cause, raising natural dispositions to a higher pitch. And we must likewise observe, that the huntsmen distinguish in dogs themselves two kinds of this disease, one of which they call the biting, the other, the sullen madness.

IN short, this distemper is a fever of that kind, in which the nervous fluid is more particularly affected, from the violent action of an extraneous fiery matter mixed with it. A *delirium* ensues, attended, according to the disposition of the body, with symptoms either of fury or of despondency, and very often with a mixture of both. For we know that these are frequently changed, and succeed to each other: a *mania* being indeed usually a heightened melancholy; that is, from great and continued lowness of spirits, apprehensions of
evil

evil increase more and more, and the imagination is possessed with *species* of things most terrible and destructive: upon which the mind is necessarily determined to actions, which by the constant order of nature follow upon such representations. And we therefore find, that, even in common fevers, patients will sometimes give warning of their growing furious: that is, of their perception of frightful images, which will of course unavoidably hurry the mind to outrageous efforts.

BUT the *Hydrophobia* (though it is commonly thought to be so) is no part of this *delirium*: as will appear anon.

FROM the description we have given, it may, I think, be concluded, that there is in all these cases

cases some degree of inflammation, with too great a tension and driness of the nervous membranes, and too much elasticity and force in the fluid, with which they are filled: that by this they have acquired a preternatural sensibility; so that the usual impressions of outward objects, instead of an agreeable feeling, give pain and uneasiness; and inward images are so strong and lively, that the mind is surprized, and determines the spirits into the muscular organs with an irregular *impetus*.

As a proof of this, the dissection of the dead bodies generally discover the vessels in the brain distended, the *sinus longitudinalis* full of fluid blood, not coagulated, as is usual in most other diseases of the head: the brain itself and the *spinal marrow* drier than

than ordinary : the *pericardium* without liquor : the *lungs* loaded : the *arteries* full of blood, very fluid and hardly concrescible in the open air : appearances all, which shew the animal spirits to have been principally affected.

THE *Hydrophobia*, we said, is no part of the *delirium*. For the patients, being feverish and thirsty, do always desire drink, as long as they can swallow it : at last they find they can neither eat nor drink, but drinking is the most difficult. Now the reason is this. This fever is of the *nervous* or *spasmodic* kind : all the nerves are drawn into cramps ; particularly the muscles employed in deglutition are convulsed, their action is lost, and it is then impossible to get any thing down. To ask one in this condition to drink, is to desire him

him to choak himself: and when he has found this to be so, he dreads the sight of liquors offered to him as much as he would a knife presented to his throat, and strives to keep them from his mouth. Liquids in such a state are swallowed with more difficulty than solids: because the instruments of *deglutition* (which are principally, the back part of the *tongue*, the hinder part of the *palate*, and the upper part of the *oesophagus*) can more effectually embrace and act with their joint force upon solid than upon liquid substances. And besides this, the *epiglottis* (which must always be closely shut at this time) is more powerfully pressed down by a solid than by a liquid body. When therefore the united force of these parts is taken away by convulsions, some part of the liquids will

slide down into the *aspera arteria*: upon which a suffocation must immediately follow. This disease therefore should have been called Δυσκατάποσις, a difficulty in swallowing, rather than Ὑδροφοβία, a dread of water.

It will serve both to illustrate and confirm this reasoning, to take notice, that there are other distempers besides this, (and all indeed of the nervous kind) in which the same frightful symptom is sometimes observed. Authors (*e*) have remarked it in malignant fevers: and a common melancholy has been seen to end fatally in it (*f*). I have known it, in the highth of a violent *hysteric* disor-

(*e*) Schenckius de Venen. Animal. Salmuth. Observ. Cent. ii. Obs. 52.

(*f*) Ephemer. German. ann. 1687.

der, to have continued for many hours, till the convulsive motions in the throat were quieted by proper medicines: and I remember a case, in which fits of a palpitation of the heart were attended with so great a degree of it, that it seemed not to differ from the true *Hydrophobia*.

ON the other hand, it has sometimes happened, that this bite has been followed with all the other usual symptoms, even to a fatal degree, and yet no *Hydrophobia* has appeared. A learned physician assured me, that in *Shropshire* he saw three patients in one year, who, at the ordinary time of about thirty or forty days after the wound, all fell into such nervous disorders as have been described, a fever, *delirium*, oppression of the breath, palpitation of

B b 2

the

the heart, spasms, *etc.* and died on the third day : yet none of them, during this melancholy scene, had any difficulty of swallowing, or shewed any signs of a dread of liquids.

THE *Hydrophobia* therefore is only a local convulsion, which, when the universal feverish affection of the nervous system is come to the highth, is very seldom absent : but though it be, the spasms of all the other parts may prove mortal. And because this fever of the spirits is rarely so violent in any cases, except the bite of a mad dog, as to produce a difficulty of swallowing ; this symptom has been thought to be peculiar to that poison.

NOTHING seems more wonderful in this whole affair, than that
the

the venom should as it were lye latent in the body so long a time before it discovers itself. Now if, as has been said, the poisonous *saliva* acts upon the nervous fluid in the manner of a ferment, it may well be conceived that before this can have a sensible effect, it must make some alteration in the more solid fibres of the brain, by inducing perhaps that tension and driness of the membranes, which we have mentioned. This in different constitutions will be done in a different space of time : nay it may so happen, that this ferment being weak, and the constitution strong, no visible mischief may ensue, till some accidental alteration in the body unluckily gives it an additional force : as we observed in the case of the *Tarantula*, how far external heat promotes the *delirium*.

AND

AND therefore, by parity of reason, the calamitous symptoms may sometimes, by the concurrence of extraordinary circumstances, be unexpectedly brought on very soon.

MOST remarkable and dismal to relate was a case, which happened some years since in *Scotland*. The account of it I had from an ingenious and learned gentleman, very near of kin to the unhappy patient.

A YOUNG man was bit by a mad dog, and married the same morning. He spent (as is usual) that whole day, till late in the night, in mirth, dancing and drinking: in the morning, he was found in bed raving mad; his bride (horrible spectacle!) dead by him;

him ; her belly torn open with his teeth, and her entrails twisted round his bloody hands.

THE heat of the blood and spirits, from excess of exercise and wine, but more perhaps from the transports of passion in the first fury of conjugal embraces, had, no doubt, in this calamity, given such advantage to the venom, that its power was raised to a greater degree in less than twenty-four hours, than in common accidents of this kind it acquires in as many days.

WE experience every day in common nervous distempers, that the return and violence of the fits depend very much upon the action of things both within and without. We may add to this, that in some diseases, in which the blood it self
is

is infected, and the solid parts, even the bones, corrupted, the poison seems to be hid a considerable time, while it is working in the body, before its last effect appears: as particularly in venereal cases.

NEITHER will it seem strange, that a poison so different in its force, and so alterable by many circumstances, should in some subjects produce symptoms of the same convulsive kind, yet not to such a degree as to hinder *deglutition*: and these too only at particular times.

A soldier of a strong habit of body came to me not long since, who once a month was seized with a great anxiety, palpitation of the heart, and difficulty of breathing. He had been bitten by a mad dog about
fix

six weeks before he began to complain. By bleeding, cold bathing, the powder of *Lichen* with pepper, and volatil medicines during the oppression, the fits were every month less violent, and at last quite left him.

A M O S T remarkable case of this kind was communicated to me by a person of unquestioned veracity. It was this. A gentlewoman in *Yorkshire*, of the age of thirty-five years, was bit by a mad dog in the fore-finger: about a month after, she had a pain in that part, which shot up to the shoulder, and was thought to be rheumatic. This pain returned every month, just a day before the full moon, lasting generally three days. After fifteen months she fell into the *Hydrophobia*, and died the third day. Her friends then recollected

the bite to have happened so long before.

THE influence of the moon in these cases I am convinced is of some weight. The manner of its action I have attempted to explain in another place (g) : and as the proofs there given are undeniable, and very much regard the nervous fluid ; it cannot be doubted but the same power may have the like effect in a disease, in which this fluid suffers more remarkably perhaps than in any other whatsoever.

LOOKING over the histories of the many patients I have attended in this deplorable condition, I observe about one half of the number

(g) De imperio solis et lunae.

to have been attacked with the spasms preceding the *Hydrophobia*, either upon the full moon, or the day before it. And, where this is only an influence concurring with inward causes of great force, it is not to be expected, but that those should often prevail without this external assistance.

BUT it is time to come to the cure, or rather the means of preventing the effects of this terrible poison. For all authors agree, that, after the appearance of the *Hydrophobia*, the case is almost desperate : and the reason is plain from the description we have given of it, a dismal scene of the last struggles and agonies of nature yielding up to the enemy.

THE first care to be taken is of the wounded part. The ancient

C c 2 physi-

physicians (*b*), who are followed in this by the moderns (*i*), advise, where the place will admit of it, to enlargé the wound by incision; to apply a cupping glass; to burn it with a hot iron; and to keep a discharge from the ulcer by drawing medicines for many days.

I CANNOT but say, that I think all this severity needless. The design of it is to draw out the poison: but as it has been proved that this immediately affects the nervous liquor, the mischief must have taken place before applications of this kind can be made.

I THEREFORE am of opinion, (because it may however be of some

(*b*) Vid. Galen. de Ther. ad Pis. l. i. c. 16. et Aetium l. vi. c. 24. et Celsum, l. v. c. 27.

(*i*) Hildan. Obs. Cent. i. Obs. 87.

service to have a continued drain from the part) that it will be sufficient to enlarge the wound a little, and dress it with *Ung. Basilic. nig.* adding to it a small quantity of *Mercur. praecip. rub.* as a digestive.

It happens in most cases, that the wound being small, is healed up before the patient seeks for help. For this reason, and because it is of no great consequence whether it be cured or not, in the *Paper* which I published and dispersed some years since, called, *A certain cure for the bite of a Mad Dog*, I took no notice of any outward application: the rather because I thought, if any great stress was laid upon it, it might frighten those who had neglected this care, and lead them to think, that the other part of the cure would not be

be effectual without it. And I can safely affirm, that (whether any outward application was made or not) I have never known this method to fail of success, where it has been followed before the *Hydrophobia* began: although in the course of about thirty years (besides the experience made by others, both in town and country) I have used it a thousand times. I have often wished, that I knew so *certain* a remedy in any other disease: I shall therefore give the reasons of this method.

BUT before I proceed to the particulars of it, it may not be amiss to mention the most considerable medicines which have been formerly used in this case: for it will hence appear, that the like *intentions* have been pursued in all times, though by different ways.

THE injudicious jumbles of *Theriaca's*, specific *Antidotes*, etc. whether old or new, deserve no notice. That ridiculous *preservative*, the *liver* of the Mad Dog, which *Pliny* says (*k*), should be eaten rather raw than boiled, is neither good food nor physic. *Galen* (*l*) observed that it availed nothing: and I remember to have seen a poor boy die mad, who had greedily devoured almost the whole of it.

THERE are two or three remedies recommended, I think, upon rational grounds. The first is the *Cineres cancrorum fluviatilium*, ashes of the river Craw-fish. These were prepared by burning the fish

(*k*) Hist. nat. l. xxix. c. 5.

(*l*) De simpl. med. facult. l. ii. c. i.

alive upon a copper-plate, with a fire made of the cuttings or twigs of the white Briony. This *Galen* (*m*) avers that no body ever made use of without success: and before him *Dioscorides* (*n*) assured, that it is a medicine which might be relied on. This calcined powder was given in large quantities, *viz.* a good spoonful or two every day for forty days together; either alone, or rather mixed with a small portion of *Gentian root* and *Frankincense*.

ANOTHER medicine is the *Spongia vel Cynorrhodi, Rosae sylvestris*, the sponge of the Dog-rose, which is so celebrated an antidote against this and other animal poisons, that *P. Boccone* (*o*),

(*m*) Ibid. l. iii. c. 34.

(*n*) De Theriac. c. 2.

(*o*) Museo di piante rare, Obs. 2.

who

who has written a whole discourse upon its virtues, tells us, it is called in Sicily, *Sanatodos* or *All-beal*.

BESIDES these, the plant *alys-sum* or *madwort* had its name given it by the ancients, from its great efficacy against this madness. This was of two sorts, one described by *Dioscorides*, a species of the *Leucoium*, the other by *Galen*, a *Marrubium* (p). To these may be added *garlick*, *agrimony*, and *oxylapathum*.

Now it is remarkable, that all these remedies are powerful *diuretics*; the two first of the *animal*, the last of the *vegetable* kind. For, as Mr. *Ray* (q) has observed, the *Sponge of the Cynorrhodon* is

(p) Vid. Fab. Column. Phytobasan. p. 27.

(q) Hist. Plant. tom. ii. p. 1471.

an excrescence formed upon the plant, as galls are upon the oak. If it be cut, 'tis found full of white worms, being the nest of these insects; which lodging here all the winter, do in the beginning of the spring turn to flies, and quit their quarters.

ALL insects abound with a diuretic salt: but as *Cantharides* do so more than any others, therefore the learned *Baccius* (*r*) goes farther, and, from the authority of *Rhazes* and *Joannes Damascenus*, advises to give these in substance for many days together. The preparation of this *antidote* (so he calls it) is by infusing the flies in four butter-milk twenty-four hours, then drying them, and with the flour of lentils and wine making

(*r*) De Venen. p. 89.

them up into troches of a scruple weight, of which one is to be taken every day: by which means he assures us, that though the patient make bloody urine, yet that milk largely drank will abate that symptom, and that the *Hydrophobia* will be happily prevented. *Boccone* likewise informs us, that in *Upper Hungary* they give in this case five *Cantharides* in one dose to men, and to beasts a greater quantity (s).

I MUST add, that *Aetius* (t), who has collected all the medicines he could from the old physicians, affirms, that himself knew an old man, who cured those who were bit, with *common sorrel* only. He washed the wound with a de-

(s) Museo di fisica. Observ. 21.

(t) Lib. vi. c. 24.

coction of this herb, and laid it on as a cataplasm, and gave it in drink: by this means, the patient made a great quantity of turbid urine.

FROM hence it appears, that the surest remedies in all ages against this venom have been such, as provoke a great discharge by urine. Reflecting upon this, I thought it must be right to give to the public a course easily to be pursued, which by preventing the fever for a long time after the bite, and constantly promoting this evacuation, might secure the patient from danger. The method is this.

“ LET the patient be blooded
 “ at the arm nine or ten ounces.
 “ Take of the herb, called in
 “ Latin *Lichen cinereus terrestris*,
 “ in

“ in English *Ash-coloured* ground
“ *liverwort*, cleaned, dried, and
“ powdered, half an ounce. Of
“ black pepper powdered, two
“ drachms. Mix these well toge-
“ ther, and divide the powder in-
“ to four doses, one of which
“ must be taken every morning,
“ fasting, for four mornings suc-
“ cessively, in half a pint of cow’s
“ milk warm. After these four doses
“ are taken, the patient must go into
“ the cold bath, or a cold spring,
“ or river, every morning fasting,
“ for a month: He must be dipt
“ all over, but not stay in (with
“ his head above water) longer
“ than half a minute, if the water
“ be very cold. After this he must
“ go in three times a week for a
“ fortnight longer.”

THIS powder was first pub-
lished in the *Philosophical Trans-*
actions,

actions (u), from Mr. *Dampier*, in whose family it had been kept as a secret many years: and in the year 1721, it was, at my desire, put into the *Pharmacop. Lond.* by the name of *Pulvis antilyssus*. I afterwards made this alteration only, of putting two parts of *Lichen* to one of pepper, instead of equal parts, because I thought it too hot: and whereas but two or three doses of it were formerly given, I repeated it four days.

THE *Lichen*, like those already mentioned, is a warm diuretic; the pepper is added, I suppose, to make it more agreeable to the stomach: for it is distasteful and nauseous.

THIS plant (x) is so remarkable for its virtue, that it may not be amiss to give a description of it.

MR. Ray, so far as I can find, was the first who gave a distinct account of it (y) reckoning it among the *Lichens*. Our great botanist, Dr. *Dillenius*, has lately more exactly described it (z), and put it into the tribe of the *mosses*, calling it *Lichenoides digitatum cinereum, Lactucæ foliis sinuosis*. It appears indeed to be of a substance between a *fungus* and a *muscus*, soft, spongy and lanuginous. It grows close to the ground, chiefly on heaths, and in woody, shady places, near the roots and stumps of trees; which

(x) Vid. Tab. iv.

(y) Vid. Catal. Plant. Angl. ann. 1670. et Histor. Plant.

(z) Histor. Muscorum.

being commonly covered with creeping, mossy herbs, it sticks to them when it is gathered.

It is found in all countries ; and from *America* has been observed to be brought over with the *Peruvian* bark.

THE leaves when young are small, but grow to two or three inches in length, and an inch or two in breadth, divided into several segments. They are sometimes single, sometimes lying upon one another. At their extremities they produce little hard, oblong bodies, which the botanists call *Peltae*, and are undoubtedly the *seminal capsulae*. The leaves, when dry, are ash-coloured, darker on the upper part; on the under, lighter. Frequent veins are observed along them, from which here and there run small white fibres

fibres into the earth, the roots of the plant.

IT is found at all times of the year, especially after rainy seasons, that is, from autumn to winter: and therefore, as being in its freshest vigour, it should always be gathered about that time.

I HAVE also examined it by distillation; by which four ounces of it yielded, of an acid water one ounce, five drachms, one scruple and two grains; of oil heavier than water, two drachms, one scruple, sixteen grains; of coal containing fixt salt, one ounce, two drachms, one scruple, eleven grains.

BUT I proceed in the cure. To make this more effectual, I added the use of cold bathing,
E c which

which had never been recommended in this manner before. The ancients, as I shall observe presently, never applied it till the *Hydrophobia* appeared; and the common practice among us of sending the patient to the nearest salt water, as soon as may be, and there only to dip him all over twice or thrice, it is plain, cannot avail much to the prevention of a disease, which will not appear till about a month after: and therefore it ought to be continued for so long a time, if any advantage is to be expected from it: and I have indeed known many to have died raving, who had undergone this treatment. It is the pressure of the water upon the surface of the body, and the constriction the cold makes upon the fibres of the skin and the small tubes, which produce the good effect. The distension

stenfion of the vessels by the fermenting humours is hereby repressed, and a flux of urine promoted for so many days, that all danger of the nervous fever, the consequent of the instilled poison, is quite over. And if it should be thought that salt water, being heavier than fresh, will press more; this difference, in two or three immersions only, can be but of small moment, and is abundantly compensated by the greater coldness of springs (which are usually chosen for this purpose) than is felt in the sea.

THUS I have made plunging into water effectual in preventing this disease, without the danger of drowning: whereas the ancients practised the same to remove it when it appeared, with some degree at least of this hazard. For

Celsus (a), who seems first to have mentioned it, and says 'tis the only remedy, advises, if the patient can't swim, to let him be kept under water, that he may swallow it; and then at times be lifted out of it: if he can swim, to hold him under by force, that he may drink whether he will or not. This in short is drowning and recovering by turns. And I make no question, but so bold a practice was by the authority of the *Greek* physicians, from whose rich stores this *Latin* author has extracted, and digested into a small compass, the best system that ever was composed of medicine.

HOWEVER it be, the famous *Van Helmont* (b), in the beginning

(a) Lib. v. c. 27.

(b) *Ortus Medicin.* demens idea.

of the last century, having observed the great effects of this practice in *Flanders*, recommended it in a very strong manner. He saw an old man in the *Hydrophobia*, cured by submerfion in salt water. He was first held under the water about four minutes, then taken out, and dipped again twice more, each time about a minute. When he was taken out, he really thought him quite dead: but being kept warm, and laid over a barrel, he vomited up the water he had swallowed, and recovered both his life and right senses.

HE relates another remarkable story of the cure of the common *mania*, by being drowned in fresh water; and from this rightly concludes, that it makes no difference in the case, whether the water be salt or fresh. He justly remarks,
that

that great care should be taken not to give over for dead those who are drowned: adding two remarkable instances of persons who were brought to life, after they had lain under water half an hour. And to this purpose I remember, that an ingenious physician told me, that he had, not long since, in the country happened to save a man from the grave, who having been sunk in a river more than twenty minutes, was judged to be past all hopes of recovery.

THERE are many accounts upon record of those, who, after having been drowned many hours have been brought to life (*c*). This should certainly incourage the use of all means upon such accidents,

(*c*) Vid. Dissertation sur l'Incertitude des signes de la mort, at the end. Paris, 1742.

especially

especially since the trial is not difficult. The first step should be, to blow up the smoak of Tobacco into the intestins: then to warm the body by shaking and rolling about, and rubbing with warm cloaths in bed: in a word, to put the blood into motion by all manner of ways; and not to be discouraged, though no signs of life should be discovered after an hour or two spent in this good work: towards the latter end of which volatil spirits and salts may have a good effect. Neither should bleeding be omitted, when the blood is become warm enough to drop out of the veins.

BUT to return from this (I think useful) digression to the *Hydrophobia*, I must observe, that if *submersion* in this way be put in practice, it ought to be done upon the very first
signs

signs of the symptom, before the fever is come to its highth. For when it is so, there will not be natural strength to overcome the shock: and I have always found, that at this time even common bathing has proved hurtful.

BUT experiments of this kind are perhaps rather to be permitted than enjoined by physicians, for their own sakes; though it is certain, that cures more dangerous than this are every day directed: but that is generally in cases, where it cannot so evidently be known, whether the patient dies by the remedy or by the disease. In such kind of attempts, the danger from the trial is to be weighed against that from the disease: if this outweighs, 'tis not only reasonable but merciful, even with a kind of rashness, as *Celsus* somewhere expresses

expresses it, “to snatch an opportunity of doing good (*d*).”

AT least there is more humanity in such proceeding, than in stifling a miserable wretch between two feather-beds: which, as I have been informed, is the practice in a neighbouring country, and sometimes in our own.

BUT the greatest comfort is, that at any time before this scene of horror opens, simple immersion without drowning will prove effectual. For though it is best to begin the method prescribed, as soon after the accident as it can be done; yet where it has been neglected, even till a day or two before the calamity might be expected, (as was judged from the

(*d*) Cum quadam temeritate medicamenta arripere oportet.

F f

begin-

beginning anxiety and oppression of the spirits) the success has been the same.

BEFORE I quit this subject, I must take notice, (as I have hinted from *Van Helmont*) that this action of cold water upon the body, by pressure and constriction, makes it of singular service in the cure not only of *acute*, but also of *chronical deliria*. Doctor *Willis* (e) relates a very remarkable story of a lusty young woman, who, having been raving mad seven or eight days, was by his order carried abroad at midnight, and thrown naked into a river: where she swam about without help for more than a quarter of an hour; and taken out was put to bed, fell into a sleep and large sweats, and recovered without the help of any other remedy.

(e) De Delirio et Phrenit. cap. x.

BUT there is no need of instances of this kind. Our physicians, who are most conversant in the cure of these maladies, find by daily experience, that this practice has a very considerable share not only in recovering their patients, but also in preventing a relapse into the same misery.

I AM therefore sorry to read in the *Philosophical Transactions* (f), a remark of a learned gentleman, who, upon my recommending cold bathing, proposes rather the use of the hot bath: because “a cold bath, he says, shuts the pores, as a warm one opens them.” Surely he should have known, that the shutting of the pores by a short cold immersion,

(f) N^o. 443.

is naturally followed by a glowing warmth, which relaxes and opens them: and by this means promotes perspiration, without the distension of the vessels by an inflammatory heat. I am afraid no bathing, whether hot or cold, would clear a head possessed with such immechanical notions.

To say no more, whoever has rightly considered the *Bellinian* theory of *melancholy* and *maniacal* distempers (g), will easily see the reason of the surprizing effects of this safe and easy application, in dispelling the greatest calamity to which mankind is liable.

As to all other ways of curing the *Hydrophobia*, I own I have not been so happy as to find any success from the many I have tried.

(g) Vid. Bellin. De morbis capitis.

Bathing, at this time, is ineffectual. I have taken away large quantities of blood; have given *opiates* every three or four hours; tried *volatil salts*, *asa foetida*, the *rad. valerian. sylv.* with other *anti-epileptics*, in large doses; as also the famous *Indian* remedy, *musk* and *cinnabar*; laid on *blistering plasters*; cooled with nitre and emulsions of barley water, &c. All has been in vain, because too late. And what is still more discouraging is, that though sometimes I have conquered the terrible symptom, and brought the patient to drink freely; yet he has died in twenty-four hours with a fever and convulsions; a plain proof of what we have said of the manner, in which this poison operates.

HOWEVER, nothing is to be omitted to the last, be the prospect never so bad: because that may
suc-

succeed in one patient, which has not in a hundred. I have by me a letter from the learned Dr. *Boerhaave*, in which, with his usual exactness and judgment, he relates two cases of the *Hydrophobia*. In the first, according to the method mentioned in the *History of the Royal Academy at Paris* (*b*), he ordered buckets of cold water to be poured, for a considerable time, upon the patient's head; and a *clyster*, of warm water, *oxymel simplex*, and sea salt, to be injected every four hours. By this means he was brought to drink freely of small beer, and a decoction of marsh-mallow leaves, elder-flowers, and tamarinds: But notwithstanding these hopes, he died convulsed, yet calm and in his senses, in a few hours.

(*b*) An, 1699. pag. 49.

THE other case had a more happy event: for though the dread of liquids was attended with foaming, roaring, and the most mischievous rage; yet by large doses of nitre, (to which *laudanum* and *diacodium* were sometimes added); by cooling the head continually with vinegar and rose-water; bathing the feet for one hour, every night and morning, in warm water and vinegar, with salt; keeping the body open by tamarinds, syrup of violets, and frequent clysters of water and nitre; and lastly, eating almost constantly lemons with a little sugar; the poor wretch was most perfectly recovered.

BUT I must here observe, that the use of all these things was entered upon four days before the dread of water began; by which means

means the violence of the disease was, without doubt, very much abated: and I have great reason to believe, from what I have experienced, (as I have already said) that the method, I have recommended, would at that time even have prevented the calamity.

To conclude, if any relief could be expected in this desperate state, I think it would be from large bleeding, even *ad animi deliquium*, before the fibres of the membranes and vessels have lost their natural force by convulsions; nitrous medicines; and plentiful diluting with cooling subacid liquors. But after all, it will generally happen, that (as the *Greeks* said upon deplorable cases) “Death will be the physician that cures (*i*).”

(*i*) Ἰατρὸς ἰᾶται θάνατος.

ESSAY IV.

Of POISONOUS MINERALS *and* PLANTS.

THOUGH there be a great variety of internal Poisons, as well mineral as vegetable, yet they all manifestly agree in their primary effects and manner of operation; which (as is explained in the Introduction) are somewhat analogous to the mischief from venomous bites or stings: the main difference lying in this, that in the one wounds are made outwardly,

G g

in

in the other inwardly, that is, in the stomach and bowels ; but in both cases, the animal oeconomy suffers in much the same way.

“ POISONOUS medicines,” says *Dioscorides*, “ are many ; but the
 “ alterations made by them in
 “ the body common, and but
 “ few (*a*).”

OF all this kind, those of a mineral nature are the most violent and deadly, the greater gravity and solidity of their parts giving to these a force and action surpassing the mischief of vegetable juices. And therefore whereas noxious plants vary their effects in different creatures, so as to prove harmless,

(*a*) Ποικίλα μὲν γὰρ τὰ δηλητήρια Φάρμακα, κοινὰ δὲ ἢ ὀπολλὰ ἐξ αὐτῶν γινόμεναι διαθέσεις.
Alexiph. p. 399.

may perhaps beneficial and nutritive to some, as we have before observed (*b*); the strength of the stomach in these animals being sufficient to conquer and divide such corrosive substances, and their blood perhaps requiring to be recruited by such warm and active particles; a mineral malignity is not, at least so far as we know, conquerable by any, but becomes universally hurtful and destructive.

WE shall here give the first place to *Mercury sublimata*.

THIS is nothing but a mixture of *quicksilver* with *common salt*. For, though it is always prepared with nitre and vitriol added to the *salt*, in different ways, the best of

(*b*) See the Introduction.

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which is that described by *Tachenius* (c); yet neither of these enter into the composition, serving only to facilitate the work, (which they do by uniting with the alkaline parts of the salt, and thus freeing its acid from them :) as abundantly appears from this experiment, that *mercury* sublimed with the same proportion of nitre and vitriol, without salt, neither receives any increase of its weight, nor acquires any malignant quality.

THE effects of this poison, when taken, are violent griping pains, with a distension of the belly; vomiting of a slimy, frothy matter, sometimes mixt with blood, and stools of the same; an intolerable heat and thirst, with cold sweats, tremblings, convulsions,

(c) Hippocrates chymic. cap. xxiv.

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etc. as will appear from the following history (*d*).

To a large dog was given a drachm of *mercury sublimate*, mixt with a little bread. Within a quarter of an hour he fell into terrible vomitings, casting up frequently a viscid, frothy *mucus*, every time more and more bloody, and purged the same downwards: till tired and spent with this hard service, he lay down quietly as it were to sleep, but died the next morning.

THE *abdomen* being opened, a great quantity of extravasated blood was found between the liver and stomach, and between the duplicature of the *omentum* about the stomach; the guts as well as the

(*d*) Wepfer De cicut. aquatic. p. 300.

stomach

stomach were distended, and full of a frothy bloody *mucus* : on the outside they were of a livid colour, within all over red, and inflamed down to the very *rectum*. The fibrous coat of the stomach being taken off, between that and the nervous one, grumous blood was found in several places: the like was discovered here and there in the intestines between the same coats.

THE same symptoms with these, and manifest signs of a burning corrosion followed with ulcers in the bowels, *Baccius* (*d*) observed in a young man poisoned by *sublimé*, mixt with his meat.

WHAT we are here chiefly to examine is, how from ingredients

(*d*) De Venen. pag. 21.

singly innocent and harmless, so mischievous a compound can result: for as the case is very plain with respect to salt, so is it likewise now notorious enough, that quick-silver it self, which the ancients, *Dioscorides*, *Galen*, *Pliny*, *etc.* have unjustly ranked among poisons, is in many diseases, inwardly taken, of very safe and beneficial use; and that not only when disguised with sulphur, sugar, *etc.* but crude, without any correction, or vainly pretended mortification.

THIS the *Arabian* physicians first gave the hint of; *Avicen* (e) having observed, that “ they, who

(e) Can. Medic. l. iv. Fen. 6. Argentum vivum plurimum qui bibunt, non laeduntur eo: egreditur enim cum dispositione suâ per inferiorem regionem.

“ drink

“ drink it in a large quantity, receive no hurt ; its weight making a free passage through the body.” This was encouragement enough for the practice of giving whole pounds of it in the *Iliac passion*: which is oftentimes done with good success, without any frightful symptom accompanying the advantage received from its ponderosity.

AFTERWARDS it plainly appeared that this mineral, either applied outwardly, or taken inwardly, though not in so great a dose as could immediately force its way through the intestins, even when it was lodged for some time in this or that part, was not at all hurtful by any corrosive or malignant quality.

I remember, that I once found some quantity of it in the *perinaeum* of a subject taken from the gallows for a dissection, (whose rotten bones discovered what disease had required the use of it, and that, I suppose, by unction) without any marks of corrosion of the part, where it was collected.

AND *Fallopius* (*f*), *Brasavolus* (*g*), with others of great note, confirmed its harmless efficacy in the cure of the worms, not only in adult persons, but even in the more tender constitutions of children.

NOR are these the only cases, in which good service may be had

(*f*) De Morb. Gallic. cap. lxxvi.

(*g*) De Morb. Gall. inter Autores de Morb. Gall. pag. 599.

from this weighty fluid. He that rightly considers the state of the animal oeconomy, the various alterations it suffers from the stagnation of its more viscid juices in the smallest canals, and how much the impulse and force of the circulating blood, by which obstructions are to be removed, must be increased by its carrying along with it such particles as the mercurial *globuli*; will perhaps see good reason to allow, that the prudent management of quick-silver may do that in some obstinate and dangerous diseases, which we cannot promise our selves from any other of our known medicines whatsoever.

BUT I shall not inlarge upon this head. The learned Dr. *Cheyne* has thoroughly explained the mechanism, by which such effects as
these

these are produced (*b*). However, as all great medicines are to be looked upon as edge-tools, so this, as much as any, requires caution: and indeed more than is commonly observed by those, who are most bold in the use of it.

FOR it cannot be denied, that the excessive gravity alone of this mineral, however serviceable in other respects, may, if it happens to lie in any quantity in the interstices of the nervous filaments, induce symptoms of dangerous consequence, as spasms, contractions, palsies, *etc.* which we find they commonly suffer, who have either been for a long time employed in rubbing quick-silver upon looking-glasses, or in any work by which they are obliged to draw in mer-

(*b*) New theory of continual fevers.

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curial fumes with their breath, or who have been too much daubed with mercurial ointments; as shall be observed anon.

NEITHER is this all. Experience has convinced us, that repeated doses of crude mercury have in some cases, even a considerable time after they have been taken, exerted their force, and thrown the body into unexpected disorders.

I remember two accidents of this kind (and one of them proved fatal), in which when small quantities had been given for many days together, a violent salivation ensued, more than two months after the use of it had been left off.

AND not long since, I saw a young lady, who having swallowed
about

about six drachms every morning, three successive days, was salivated three weeks. The flux then ceased, but returned after six months, and held a month; and once more came on, in the same manner, two months after. The breath was each time strongly affected, as is usual in mercurial spittings. So surprisngly active is this mineral, even simple and uncompounded.

WE may learn from hence, that it will be always right, in dealing with this slippery remedy, to take care that it has a free passage thro' the body; which must be done either by purging, or by combining it with substances, which will carry it off either by perspiration or urine: for what is called *alcalising* it, does not deserve the name of a preparation.

Now

Now as to *sublimate*, most certain it is, that the saline particles impart to the mercury this noxious quality; or, to speak more properly, that the salt receives from the mercurial corpuscles such an increase of its gravity and *momentum*, as renders its cutting corrosion more effectual and penetrating: for the manner, after which this matter is done, is probably this.

THE compounding parts of the mercury, though so minutely divided by the action of the fire, as to rise in the form of a fume, yet are still solid and ponderous bodies: and by reason of their extreme parvity, being perhaps simple and elementary corpuscles, they will easily be lodged in the pores and interstices of the *saline* crystals; which being composed of the atoms
of

of salt, variously by sublimation combined and united, are a kind of cutting *lamellae* or blades; the force of which could never have been very penetrating, upon the account of their lightness and easy dissolution, if the *mercury*, without blunting their edge, or breaking their figure, did not lend them an additional weight, and thus at the same time strengthen their action, and prevent their quick solution by the juices of the stomach: which cannot now disjoin their compounding parts, because the vacuities, into which they should, in order to do this, insinuate themselves, are already possessed, and taken up by the mercurial globules.

IN short, these crystals, which are to be considered as so many sharp knives or daggers, wounding
ing

ing and stabbing the tender coats of the stomach, and abrading their natural *mucus*, will irritate the nervous liquor: upon which convulsions and vomitings, with excessive pains, must follow. And the blood-vessels being at the same time pricked, all the adjacent parts will be inflamed, the blood will stagnate: then come on ulcers, which, tho' singly small, yet being many in number, do all together make up large *gangrenes*.

THIS being the nature of *sublimed mercury*, it may not be amiss to inquire, how it comes to pass, that this same compound resublimed with live *mercury* in the proportion of four parts to three, (for the *sublimate* will not take up an equal quantity) especially if the work be repeated three or four times, loses its corrosiveness to that degree

degree as to become not only a safe, but, in many cases, a noble medicine. For I do not see, that any of the chemical writers have hit upon the true solution of this *phaenomenon*.

HERE then it is to be considered, that the action of the saline crystals depending upon their solidity and largeness, these must necessarily, by every subsequent sublimation, be broken into smaller and smaller parts. The mercurial globules, (for the reasons given by the author of the forementioned *Theory of Fevers*) arising more quickly and easily than the salts, quit the interstices in which they were lodged, and the crystalline blades are divided every time more and more by the force of the fire: whereupon a new combination of parts succeeds. And although there be a greater proportion of the

I i mineral

mineral to the salts than before, which makes dulcified mercury specifically heavier than the corrosive; (for this contains two parts of salt, and one of mercury; whereas the dulcified, well prepared, has equal parts) yet the broken pieces of the crystals uniting into little masses of differing figures from their former make, those cutting points are now so much smaller, that they cannot make wounds deep enough to be equally mischievous and deadly: and therefore do only vellicate and twitch the sensible membranes of the stomach to that degree, as excites them to an excretion of their contents and glandular juices, upwards or downwards, according as the force of irritation is greater or less.

Thus a violent poison is mitigated into a vomit or purge: nay, it may easily happen, (especially in
robust

robust constitutions, and if the bowels be at the same time by any means defended against the stimulating power of the medicine) that this twitching may be so slight, as to be almost insensible, and hardly troublesome. And then the mercurial globules, being freed indeed from most of the saline parts in their passage thro' the *primae viae*, but still having a mixture of some few of them, are quickly conveyed into the blood: where, by their motion and weight, they must necessarily dissolve the preternatural cohesions of all the liquors, particularly of those, which circulate in the smallest canals, and are most viscid and tenacious, making them more fluxil and thin, or of more easy secretion. Whereupon all the glands of the body are, as it were, set to work, and scoured of their contents: but

the salival ones especially, being many in number, very large and wide, and the juice they separate of a tough and ropy substance, so that a considerable quantity of it is accumulated, before it is forced out at the orifices of the ducts; these effects will be most remarkable in them, and a salivation or spitting must continue so long, till the active mineral particles are, through these and the other passages, discharged out of the body.

As the difference between mercury corrosive and dulcified lies in a greater and lesser degree of operation and force, so this same consideration distinguishes the several preparations of this mineral from each other; which though very many, yet do all vary their effects in the body, only according as
the

the mercurial globules are differently combined with salts, and the points of these more or less broken by the action of the fire, in the burning of spirits upon them, and such like managements: and therefore however dignified with the great names of *Arcana*, *Panacaeae*, *Princes Powders*, etc. they do not afford us any thing singular and extraordinary, beyond what we may with equal advantage promise our selves from some or other of the most common and usual processes.

WE may also fairly conclude from this reasoning, that the safest way of raising a salivation is by internal medicines; since whatever mischiefs can be apprehended from these, may in a greater degree follow from the external use of mercury: not only because, as we
have

have already hinted, the mineral globules, being intimately combined with salts in the several preparations given inwardly, will, by the irritation of these, be easily and fully thrown out at the organs of secretions, till the blood is quite discharged of its load; whereas, in all the dawblings with mercurial ointments, we can never be certain, that none of the heavy particles are left lodged in the interstices of the fibres, or cells of the bones; but also, in as much as by computing the portion of mercury in all the doses necessary to promote a spitting, and the weight of the same mineral usually applied when this is done by unction, it will appear, that the quantity in the latter case vastly exceeds that in the former, and consequently that the inconveniences to be feared will be in the same proportion.

THERE-

THEREFORE this external management of quick-silver is chiefly to be recommended, where the constitution is not broken, or ulcers and tumors require a particular cure, by *liniments, etc.* and a more thorough cleansing of the body. And even in such cases, it will certainly be best to anoint daily with small quantities, and not to raise a high spitting; but promote the other secretions, particularly sweating and urine, by plentiful drinking of thin liquors; and also, if there be occasion, by laxative medicines: for it is well known, that cures are often wrought by these means, although the mouth has never been ulcerated by the mercury. At least this method will be a remedy for a time, and enable the patient to recover strength; so that he may afterwards,

wards, if it be necessary, undergo a more severe treatment.

It may be observed, that as the earliest use of mercury was in unguents and emplasters, so most of the prejudices and outcries against it are owing to effects produced this way. For the first attempts of the cure of venereal maladies by this remedy, were learned from the *Arabians* (*i*), who, having recommended mercurial ointments in the *lepra* or *scabies*, gave a handle to the *Italian* physicians to try their efficacy, in removing the foulness of the skin from a new and terrible contagion: neither were they sparing of their liniments, which they continued to rub in for twelve, fifteen, nay, sometimes

(*i*) Vid. Joan. Baptist. Montan. tract. De morb. Gallic. inter autor. De morb. Gall. p. 482. et Fallop. De morb. Gall. cap. lxxvi.

for above thirty days together (*k*). So that it is no wonder, if they often met with very untoward symptoms from so severe a treatment, and if, (as some of them (*l*) affirm) they now and then found *mercury* in the rotten bones of their patients, who had, it may be, suffered too much both from their disease and their physician.

THERE are many histories of this kind; neither are instances wanting, in living persons, of

(*k*) Nicol. Massa De morb. Gall. tract. iv. cap. 2.

(*l*) *Argentum vivum* accepi ex osse cujusdam corrupto, quem perunctum ab empiricis plus decies ferebant, non semel emanavisse. Anton. Gall. in lib. De ligno sancto non permittendo.

Non semel in sepulchris *argentum vivum* in mortuorum capitibus reperi. Anton. Musa Braſa volus in tract. De morb. Gallic.

mercury running out of the body, from a tumor, either suppurated, or opened by a caustic : nay there is a case upon record, in which, upon opening a vein, some drachms of it flowed out with the blood (*m*).

To this examination of the properties and effects of *mercury*, I shall add an inquiry into the nature of another *mineral poison*, not very unlike it, either in make or its action : This is *arsenic*.

THERE is some confusion in the accounts, which authors give of this mineral. This arises from their not distinguishing the *arsenic* of the ancients from what is now so called. I shall therefore exactly describe both one and t'other,

(*m*) Vid. Ephemerid. Germanic. Dec. 3. ann. 5. Observ. 172.

not only from the latest writers of natural history, (for what *Agri-
cola*, *Matthiolus*, *Schroder*, and
even *Wepfer*, the best authors ex-
tant when this book was first
published, have delivered to us
on this subject, is all wrong) but
more particularly from some ex-
periments communicated to me
by the learned Dr. *Hampe*, a most
excellent chemist, physician to her
royal highness the princess of
Wales.

THE *arsenic* of the *Greeks*,
'Αρσενικόν or Ἀρρῆνικόν, was what
the *Latins* named *Auripigmentum*,
we *Orpiment*.

THIS is found in *Greece* and
Hungary, in particular mines and
veins, and is never mixt with any
other mineral. It is of a foliaceous
or laminated texture, and contains a

K k 2 — great

great deal of sulphur : as appears by its inflammability, and by its giving, when mixt with *mercury sublimate*, a true *cinnabar*. By simple fusion it runs into a mass of a cinnabarine colour, called *sandaracha*. Though it yields a *regulus*, in every respect like to the *regulus* of true *arsenic*, yet it does not act as a strong poison. *Hoffman* (n) gave a good quantity of it to a dog, without any harm. The reason of this is, because its metallic particles are combined with sulphur, and not with salt, at least in any considerable degree.

SUCH a composition makes this substance more useful in painting than in physic; and, together with its colour, has induced those

(n) Observ. Physico-chym. 1. iii. Obs. 1.

chemists,

chemists, who have fancied that metals may be transmuted, to take it for the subject matter of their great work: for so they call the making of gold. They have very fondly grounded their hopes upon some odd aenigmatical verses in the *Sibylline Oracles* (o). A man of universal knowledge, (Mr. *Leibnitz*) has pretty fairly interpreted this riddle to mean *arsenic* (p). But be this as it will, true it is that this great expectation from this mineral is as old at least as the time of *Caligula*, that is, of a more ancient date considerably, than the far greatest part of these supposititious and ill-contrived compo-

(o) Ἐννέα γράμματ' ἔχω, τετρασύλλαβός εἰμι, νόει με.
 Αἱ τρεῖς αἱ πρῶται δύο γράμματ' ἔχουσιν ἑκάστη,
 Ἡ λοιπὴ δὲ τὰ λοιπὰ, ἣ εἰσὶν ἄφωνα τὰ πέντε.
 Τῶ παντὸς δ' ἀριθμῷ ἑκατονταδὲς εἰσι δις ἐπὶ τὰ,
 Καὶ τρεῖς τρεῖς δεκάδες, ἣ δις τρία. Lib. i.

(p) Vid. Miscellan. Berolin. tom. 1. cap. ii.

tions, which bear the sacred name of *oracles*: for that covetous emperor, as *Pliny* relates (*q*), ordered a great quantity of *orpiment* to be melted and managed, that he might extract gold out of it; and made some, but (as it usually happens in such experiments) the profit did not answer the expence.

WHAT we now call *arsenic* is of three sorts, white, yellow and red. All these are factitious, and very probably not known to the ancients. They are made in this manner.

AT *Schneebergh* in *Misnia*, there is found, in great quantities, a particular kind of mineral called *co-*

(*q*) Nat. Hist. lib. xxxiii. c. 4.

balt, of a greyish colour and ponderous. This roasted and calcined, in a furnace made for that purpose, yields a white smoak, which gathers, at the end of a very long funnel, into an ash-coloured powder, as fine as flower. This, with the addition of a true proportion of pot-ash, is sublimed, and gives the white crystalline arsenic (*r*).

THE metallic earth, of a vitreous nature, which remains after this operation, melted with a due proportion of calcined flints and pot-ash, makes what is called *Smalt*. The *cobalt* contains about three parts of *arsenic*, and one of this earth.

(*r*) See Kunckel's Annotations upon Neri's Art of Glafs. German. and Philosophical Transact. N^o. 293.

WHEN newly sublimed and perfectly pure, it is a shining white transparent body, not unlike to a metallic glass: in the air, it changes its bright whiteness to a milky colour, and becomes intirely opake. It is not inflammable; but evaporates in the fire, without leaving any earth behind, in a white smoak, smelling like garlick. It affords a semimetallic *regulus*, both by sublimation and precipitation. The first is foliaceous, light and spongy; the other ponderous, though also of a foliaceous texture, and resembles *bismuth*. This last *regulus* may be made without iron, with the black *Flux* only, or with nitre and tartar, in the same manner as is the *regulus* of *antimony*; but it requires a nice operator.

WHITE

WHITE *arsenic* is intirely soluble in water. If one part of it be sufficiently boiled in fifteen parts of distilled or rain-water, it gives by evaporation salts of triangular planes, which unite into *octoedral* crystals: and in these, either beat to powder, or dissolved by boiling, metallic globules, resembling those of quick-silver, are plainly discovered by the microscope. Which confirms what *Kunckel* says, that a great part of *arsenic* is *mercury* (*s*): so that *arsenic* may be defined to be *a volatil metallic salt*.

YELLOW *arsenic* is prepared by subliming white *arsenic* with the addition of a tenth part of *sul-*

(*s*) Chemical philosophy confirmed by experiments, chap. xi.

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phur. This is not so transparent as the white, but splendid, and very like to a metallic yellow glass.

THE *Red* differs from the *Yellow* only in this, that a greater quantity of *sulphur* is added, together with a particular kind of a red cobalt called *kupfer nickel*.

THIS being the composition of this mineral, we may readily understand the manner of its deadly operation. The case is plainly the same with that of *sublimate corrosive*: and as there the salts combined with the mercurial globules form cutting crystals; so here the metallic particles, which make the *regulus*, give a force and solidity to the saline bodies, which wound the stomach and guts, as the others do,

do, even to such a degree as to cause mortifications.

THE several histories related by *Wepfer* (*t*) put this out of question: it is sufficient to our purpose to mention one.

A DOG having eat some fat mixed with white *arsenic*, died the next day. The upper part of the stomach, when opened, was red and inflamed; the coats thinner than ordinary; the bottom of it was covered with a fetid slime, and some pieces of fat: the thin guts, were so corroded as to be pervious in three places, two of the ulcers so large that they would easily admit a bean. The cavity of the *abdomen* contained a yellowish *ichor* tinged with blood.

(*t*) Cicut. aquat. hist. p. 274, et seq.

THE case being thus, one would wonder, what should induce authors to prescribe so corrosive a mineral to be worn upon the pit of the stomach, as an *amulet* against the plague. This trick we may well believe to be dangerous, when *Lionardi di Capoa* (*u*) tells us of a child killed by the violent vomiting and purging, occasioned from a slight wound made in the head by a comb wet with oil, in which *arsenic* had been infused: for the pores of the body being opened by heat and exercise, some of the noxious *effluvia* may easily insinuate themselves into the part. Accordingly *Crato* (*x*) observed an ulcer of the breast caused by this

(*u*) Incertezza de' medicamenti, p. 82.

(*x*) Epistol. 168.

application; *Verzascha* (y) violent pains, and fainting fits; *Diemberoeck* (z), and Dr. *Hodges* (a), death itself.

THE truth of the matter is, this practice seems to owe its origin to a mistake. Perhaps some of the *Arabian* physicians had commended *darfini* worn in a bag for a preservative in plague time. This in their language signifies *cinnamom*: but the *Latin* interpreters retaining the same word in their translations, (as was frequently done) one or other afterwards not understanding its meaning, and deceived by the likeness of the sound, substituted in its place *de arsenico*, as if *darfini* were all one

(y) Observ. 66.

(z) De peste, Histor. 99. Annotat.

(a) De peste Londinens. p. 239.

with *zarnick*. The authority of the first author served to propagate the error; nor were those wanting, who reasoned upon the matter, and found it agreeable to their philosophy, that this mineral should draw to it self and concenter the *arsenical effluvia* out of the air, and thus secure the body from their infection: these being, as they imagined, the common cause of pestilential diseases.

HAVING thus particularly discoursed of the nature of these two poisons, I shall not need to insist upon any more out of the mineral kingdom.

ALL of them bear some analogy to the former, and are more or less dangerous, according as their salts receive a differing force from the metallic particles. For
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this reason as we have observed, that the most virulent may be mitigated by breaking the points of the saline crystals; so on the other hand, the most innocent minerals may become corrosive, by combining them with salts: as we see in the several preparations of *silver*, *antimony*, *iron*, *etc.*

THIS puts me in mind of making a remark, which I think both curious and useful. It is observed, that the fumes of *lead* are very noxious to those, who are constantly employed in melting it, as *Plumbers*, *Castors of shot*, *etc.* A learned physician, of my acquaintance, lately told me, that a great artist in this way had assured him, he had found by experience, that this inconvenience did not attend the melting new lead, in any degree so much as it did the melting
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it when it was old : that he had workmen, who had for many years laboured under him, in casting new metal, and had never suffered in their health by it. This difference he rightly ascribed to the corrosive quality, which *lead* acquires from the salts in the air, by lying long exposed to it.

FOR the fumes of minerals are only parts of the respective substances minutely divided ; and therefore will not only produce suitable effects, but also in a more dangerous way ; being not so much guarded against, and yet admitted farther into the body, that is, into the lungs, in respiration, as well as into the stomach, by means of the *saliva* : not to mention the impression upon the spirits in the nostrils, which must certainly be very considerable.

I HAD

I HAD once in my possession, given me by an ingenious chemist, a clear liquor, which though ponderous, was so volatil, that it would all fly away in the open air, without being heated; and so corrosive, that a glass stopple of the bottle which contained it, was in a short time so eroded, that it could never be taken out. The fume from it was so thin, that if a candle was set at some distance from the bottle, upon a table, the heat would direct its course that way; so that it might be poisonous to any one that sat near to the light, and to no body besides. I know the composition of this *stygian* spirit; but it is better that the world should not be instructed in such arts of death. It is sufficient to our purpose to observe, that it was salts combined with metallic bodies.

Of POISONOUS PLANTS.

FROM *Minerals* we come to poisonous *Plants*. The most noted of these, are the *cicuta* and *aconitum*. The former is of two sorts, our common *hemlock*; and the *aquatica*, which Mr. Ray calls *Cicutaria palustris tenuifolia*.

WHAT the *cicuta*, so much in use of old for killing, especially at *Athens*, was, we don't know: it is most probable, that it was not a *simple* but *compounded* thing. The history of the noble death of *Socrates*, related by his disciple *Plato* (a), (if this is not wrought

(a) *Phaedon*. sub finem.

up with more of *ornament* than *truth*) seems to evince it to have been a mixture of some anodyne juices with others of a corrosive nature. *Theophrastus* (*b*) says, that *Thrasylas*, a great physician, had invented a composition, which would cause death without any pain: and that this was prepared with the juice of hemlock and *poppy* together; and did the business in a small dose.

AN extract of this kind might perhaps take away life, with such symptoms, as this great philosopher went off with, *viz.* eyes fixt, heaviness and insensibility in the legs, then great coldness in them, which by degrees seized the vital parts.

(*b*) *Histor. Plant. lib. ix. c. 17.*

I AM the more inclined to believe this, from what is recorded anciently of the people of *Marseilles*, that they had a poison kept by the public, in which *cicuta* was only an ingredient; a dose of which was allowed by the magistrates to any one, who could shew a reason why he should desire death. For, this custom, as *Valerius Maximus* observes (*c*), came from *Greece*, particularly from the island *Ceos*, where he saw an example of it in a woman of great quality, who, having lived very happy ninety years, obtained leave to die this way, lest by living longer she should happen to see a change of her good fortune.

(*d*) Lib. ii. c. 8. Vid, *Aelian. Var. Hist.* l. iii. c. 37.

BUT the *cicuta aquatica*, at least in our colder countries, is much more violent than the other. *Wepfer* has, in a very learned treatise, described its deadly effects in some children, who by mistake had eat of the roots of it. These were excessive pain and heat in the stomach; terrible convulsions, with the loss of the senses; distortion of the eyes; flowing of blood out at the ears; the jaws so fixt shut that no force could open them; efforts to vomit, but nothing thrown up; frequent hickups; with a great distention and swelling, especially at the pit of the stomach; and when death had concluded the tragedy, a continued running of green froth at the mouth.

STALPART *vander Wiel* gives
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the like account of two persons killed at the *Hague* by the same roots (*e*).

IN a dog, that, for experiment's sake, died by this poison, the stomach when opened was found quite constricted, and shut up at both orifices; its inward surface red, with livid spots here and there.

THUS it appears, that this plant consists of hot, acrid and corrosive parts; which by rarefying the natural juices of the stomach, and hurting its nerves, are the cause of those terrible disorders, which have been described.

FOR, upon the sense of a violent irritation and pain, the ner-

(*e*) Observat. Cent. 1. Obs. 43.

vous fluid is by the mind, in a kind of surprize and hurry, determined in great quantities to the affected part; in order to throw off the cause of the disagreeable sensation: which, if the *stimulus* be not over great, is done by the contraction of the fibres of the stomach, and muscles of the *abdomen*, causing vomiting. But when the painful twitching is quite intolerable, the business is over-done; and the fibres are drawn into spasms, which contract the mouth of the stomach, so that the noxious matter can't be discharged, but is kept there in continued force and action. And by the communication of the infection through the nervous system, the whole body quickly suffers; the blood-vessels are torn and broken by the violence of the convulsions, and blood gushes out from the ears, nostrils, *etc.*

THIS

THIS universal muscular contraction was the reason, that one of the children attended by *Wepfer*, made urine in the midst of the agony, to the highth of five or six feet, with a strength and violence surprizing to the spectators.

THE case of *aconitum* is much the same. This is our *napellus* or *monks-hood*; and its effects do so nearly agree with those now related of *cicuta*, that I shall not need to recite them: the experiments of *Wepfer* (*f*) are full and convincing. And indeed, as all the histories, which this same author has so carefully given us, of trials made with several vegetable poisons, *solanum*, *nux vomica*, *cocculus Indicus*, etc. on dif-

(*f*) Pag. 176. seq.

ferent creatures, put it out of all doubt, that the common mischief of these is a twitching and slight inflammation of the stomach, with an affection of the nervous fluid; so it appears from hence, that virulent Plants, although they may be distinguished even from one another by particular virtues, do however kill by a like operation and force, which differs chiefly in degree from that of noxious minerals.

NOR is it at all strange, that the symptoms from a vegetable, and from a mineral virulency, should be so different, although of the same kind, and only of unequal force: for the more solid parts of minerals, eroding the coats of the stomach, induce a perfect mortification and gangrene, and thus do their work at once; whereas the

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weaker salts of *Plants* can make only pungent irritations, upon the painful sense of which the animal is thrown into convulsions, and dies by these prevailing in all parts of the body.

UPON this score, though mineral poisons do not commonly pass the *primae viae*, vegetable ones in some cases may: just as we find that those medicines, which have a great degree of irritation, presently induce a vomiting; whereas the same twitching a little weakened suffers them to pass into the intestins, and work downwards by stools.

By this we may perhaps give some guess at the nature of those poisons, with which they tell us the natives in some parts of *Africa* and *India* are so expert at killing,
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they can do it in a longer or shorter time. These are most probably either the fruits, or the inspissated juices of corrosive plants, which inflaming the bowels, may cause little ulcers there, whose fatal consequences, we know, may very well be slow and lingering.

THIS I am the rather induced to believe, because an ingenious surgeon, who lived in *Guinea*, told me, that the antidote, by which the Negroes would sometimes cure those who were poisoned, was the leaf of an herb, which purged both upwards and downwards. For by this means the stomach might be cleared from the adhering corrosive parts of the venom. Yet I can hardly think it possible at the same time, that they should be able, by varying the composition or quantity of the

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dose, to ascertain the time in which it shall kill, to a week, month, *etc.* nor indeed have I ever met with any person, who could attest this to be matter of fact : tho' repeated trials and observations may help one well practised in such tricks to give notable conjectures in this point.

THE ancients indeed pretended much the same thing with their *aconitum*, of which they seem to have made a kind of secret and mystery: as we learn from *Theophrastus* (g), who says, “ the ordering of this poison was different, according as it was designed to kill in two, three months, or a year.” But this he relates only as a common tale or opinion, and not as a story, to

(g) Hist. Plant. l. ix. c. 16.

which

which himself gave any manner of credit.

It is very plain, that the common cure of all poisons, taken into the stomach, must be by throwing them up again by vomiting as soon as possible, and defending the membranes from their pungent acrimony. Drinking very large quantities of warm milk, with oil of sweet almonds, till the vomiting ceases, will answer the first intention: the other, in mineral poisons, (for the effects of the vegetable, after they have been vomited up, generally go off, by diluting plentifully with soft and fat liquids) requires particular care, which, I think, may be in this way. We have found the force of these to depend upon a combination of metallic particles with saline crystals: therefore the disuniting of these

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these must destroy their power. This (as *Kunckel* (*b*) has hinted) may be done, by drinking a quantity of a *lixivium*, made by a solution of *salt of tartar* in water: for this salt, uniting with the corrosive crystalline salt, will, (after some degree of effervescence) kill it, as the chemists speak; by which means, being disengaged from the mineral globules, it will be rendered of no effect.

THIS practise is founded upon a remarkable experiment, related by the same author, which is this. A child's head, for the cure of scabs, was dawbed over with an ointment made of *ung. pomat.* and *sublimate corrosive*. This immediately caused such a swelling, with

(*b*) Chemical philosophy confirmed by experiments.

intense pain and inflammation, that the eyes and nose could not be seen. In this extremity, when the patient was thought to be dying, a learned chemist, happily coming to the house, advised to foment the head all over with a strong *lixivium*: this, in a few hours, quite removed the terrible symptoms.

WHAT such an application could do outwardly, it may, upon the same rational grounds, be presumed it will perform likewise in the stomach, at least in some degree; and thus become an *antidote* against the most violent of all known poisons.

ESSAY V.

Of O P I U M.

THE ancients having experienced, that *Opium* would oftentimes kill, though taken in no large quantity, ranked it with poisons, and gave it the first place among those, which from their stupefying quality they called *narcotic*.

TRUE indeed it is, that we do every day find this to be, in a
small

small dose, one of the most noble remedies in the world. But it is not worth the while to engage in the controversy, how far poisons are medicinal: since it is notorious enough, that medicines sometimes prove poisonous. And take the matter as we please, it may serve to very good purposes to understand the manner of operation of so celebrated a drug, and help us in a great measure to ascertain its use in different cases, if we are beforehand rightly apprised of its nature and way of acting.

IN order hereunto, it is necessary, besides some other *praecognita*, since one of the chief virtues of this medicine is *hypnotic*, to define distinctly what sleep is, or rather, (to avoid confusion and disputes about words) what difference there is between an animal body,

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when asleep and when awake: for I suppose the history, manner of preparing, *etc.* of *opium*, to be already known.

FIRST then, there is no one but knows, that in sleep there is a cessation from action. When waking, we walk, discourse, move this or that limb, *etc.* but in natural and undisturbed rest there is nothing of all these: that is, whereas, being awake, we perform several motions by the voluntary contraction of our muscles; when asleep, those muscles only are contracted, whose action is in a manner involuntary, or to which the mind has always so constantly determined the spirits, that it does it by a habit, without the intervention of the reasoning faculty: such are those of the heart and breast.

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So that there is at this time a kind of relaxation or looseness of the moving fibres of the several members ; or at least such a quiet position and state of them, by which all the antagonist muscles are in an *aequilibrium* and equality of action, not overpowering one another. For this indeed seems to be one great design of sleep, to recover to the parts over-stretched by labour their former tone and force : and therefore we naturally, when composing our selves to rest, put our body into that posture, which does most favour the particularly wearied limbs, and conduce to this end.

IN the next place, it is very plain that there is in sleep not only a rest, and suspension from acting, of most of our bodily organs, but

even of our thinking faculty too that is, (for I would prevent cavils) a ceasing from such thoughts, as when waking we are exercised about, which we reflect upon, and will to employ our mind with. For though dreams are thoughts, yet they are but imperfect and incoherent ones, and are indeed either so faint and languid representations, as to be consistent with our sleep, as some may be: or else if they be strong and lively, they are, as every one knows, the interruption and disturbance of it.

FROM hence it will follow, that the motion of the arterial fluid must be, *caeteris paribus*, more sedate, even and regular, in the time of sleeping than waking. For, besides the various alterations, which in the latter state this receives

ceives from the several passions of the mind, the very contractions of the muscles themselves in exercises of the body differently forward its course: whereas in sleep the force of the heart and pectoral muscles being more constant and uniform, gives it a more calm and equally continued impulse.

HENCE also it will come to pass, that the influx of the liquor of the nerves into the organs of the body, as also its reflux towards the brain, is in sleep either none, or very inconsiderable: that is, that this fluid has at this time but little or no motion. For 'tis muscular action and sensation that require it to be thus determined this way or that, which are now hardly any. And yet by the arrival of blood at the brain, this juice will still be
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separated there, fit to be derived into its canals or tubes: so that by this means there will be a kind of accumulation, or laying up in store, of spirits for the offices and requirements of waking.

THUS we may in short look upon the time of watching, as the time of wearing out, or the destruction of the animal fabrick; and the time of sleep, as that in which it is repaired and recruited: not only upon the account of what we have just mentioned concerning the nervous liquor, but also with respect to all the other parts, as well fluid as solid. For action does necessarily by degrees impair the springs and organs; and in motion something is continually abraded and struck off from the distractil fibres, which cannot otherwise

therwise be restored than by their being at rest from tension. Besides that, such a regular and steady course of the blood, as we have observed to be in sleep, is by far more fit and proper for nutrition, or an apposition of parts to the vessels, which an uneven hurry of it is more apt to tear off and wash away.

THE case being thus, it is very plain, that whatsoever can induce such a disposition of the fluids and muscular parts of the body, as this we have described, will so far cause sleepiness. And in like manner, when any thing interposes and hinders this composedness and tranquillity, the removing of the impediment will be the causing of sleep: inasmuch as this is only reducing the animal oeconomy to
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its right state, in which by natural order there must be a succession of sleeping and waking.

THUS it appears how necessarily continued exercises make us sleepy, since these exhaust the juice of the nerves; that is, both lessen its influx into the organs of motion, and incline the mind not to determine it any longer that way, upon the account of the pain and uneasiness, with which too violent a tension of the parts is always attended: which therefore we must needs desire to relax, or lay to rest.

THAT sleepiness, which follows upon a fulness of the stomach after eating or drinking, is owing to a different cause; and does indeed so nearly fall in with the effects of
opiate

opiate medicines, that it requires a particular consideration.

As hunger, or the emptiness of the stomach, is a painful sensation; so the satisfying or removing, of this, is a pleasing or agreeable one. Now all pain is a *stimulus* upon the part affected; and this, we all know, being attended with contractions of the pained membranes, causes a greater afflux than ordinary of the nervous juice that way. On the other hand, pleasure, or a delightful sensation in any part, is accompanied with a smooth undulation, and easy reflux of the liquor of the nerves towards the brain. This is, as it were, the entertainment of the mind, with which being taken up, it does not determine the spirits to the organs of motion: that is, there is such a relaxation of the

muscular fibres, and such a disposition of the nervous fluid, as we have observed to be necessary to sleep.

THIS is the reason of that chilliness in the limbs, which we commonly complain of after a good feast.

IF it seem strange, that a pleasure in the stomach should so powerfully influence the mind; let it be considered, on the other hand, how violent effects an uneasy and disagreeable sense in the same part does produce; what a terrible agony two or three grains of *crocus metallorum* throws the whole fabrick into; how readily the fluid of the nerves is with a more than ordinary *impetus* determined and commanded into the muscles of the stomach and *abdomen*, in order
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to throw off the enemy, and remove the ungrateful sensation.

Now the consequences, which we have ascribed to a pleasing sense in this part, are only just the contrary of these we find the opposite affection of pain induces. And indeed pleasure and pain are two great springs of action in the animal oeconomy; the changes they make in the fabrick are the causes of many effects which seem surprising, because we do not regard the mechanism, by which they are produced: but these must be more considerable in the stomach than any where else; this part being, for very wise purposes, of so acute a feeling, that some philosophers have for this reason thought it to be the seat of the soul.

BESIDES this consideration, we must take notice, that the stomach, being distended with food, presses upon the descending trunk of the *aorta*, and thus causes a greater fulness of the vessels in the upper parts: whereupon the brain is loaded, or the derivation of spirits into the nerves diminished, and inactivity or drowsiness insues. From hence proceed those flushings in the face, redness, *etc.* after plentiful eating or drinking, most visible in those, whose vessels are lax and weak: as in exhausted and hectic persons they more especially are.

THUS we may, without the assistance of the new chyle entering into the vessels, account for that inclination to sleep, which follows upon a full stomach;

stomach; though we must also allow the distension from this to be a considerable cause of the same effect. But this does not happen immediately, nay, sometimes perhaps not within two or three hours after eating: and therefore the sudden drowfiness must (as well as the present refreshment and reviving, which meat gives) be chiefly owing to some more speedy alteration.

WE come then in the next place to *opium* itself; the chemical *analysis* of which, out of six ounces, afforded, of a volatil alkaline spirit, not very unlike to that drawn from harts-horn, two ounces; of fetid oil, five drachms, one scruple, sixteen grains; of coal, void of salt, two ounces, two drachms, one scruple, four grains.

THE virtues therefore of *opium* are owing to a volatil *alkaline* salt, intimately mixt and combined with an oily, sulphureous substance: the effects of which we must consider, first of all upon the stomach, and afterwards, when they have passed the *primae viae*, upon the arterial fluid it self.

AN agreeable sensation produced in the stomach, together with a distension of its membranes, we observed before to be the cause of that sleepiness, to which we are so prone after eating. The one of these engages the mind, the other acts upon the body. For pleasure amuses the soul, as it were, so that it does not think, or exercise it self about any outward objects: that is, is inclined to rest. And the fulness of the vessels in the brain checks

checks and hinders, in some measure, the derivation of the nervous juice into the organs, *etc.*

Now they, who take a moderate dose of *opium*, especially if not long accustomed to it, are commonly so transported with the pleasing sense it induces, that they are, as they oftentimes express themselves, in Heaven: and tho' they do not always sleep, (which proceeds from the presentation of pleasing images to the mind being so strong, that like dreams they over-engage the fancy, and so interrupt the state of rest) yet they however enjoy so perfect an indolence and quiet, that no happiness in the world can surpass the charms of this agreeable extasy.

THUS we have from this medicine, but in a far more eminent degree,

degree, all those effects, which we observed to follow upon that grateful sense in the stomach, which a moderate fulness produces. For no bodies are so fit and able pleasingly to affect our sensible membranes, as those which consist of volatile parts, whose activity is tempered and allayed by the smoothness of some lubricating and oily ones: which, by lightly rarefying the juices of the stomach, and causing a pleasant titillation of its nervous coat, will induce an agreeable plenitude, and entertain the mind with ideas of satisfaction and delight.

THE case being thus, we easily see upon what mechanism the other virtues of *opium* depend, its easing pains, checking immoderate evacuations, *etc.* not only in that the mind being taken up
with

with a pleasing sense, is diverted from a disagreeable one ; but all pain being attended with a contraction of the part, that relaxation of the fibres, which it now causes, eludes and destroys the force of the *stimulus*.

IN like manner, in immoderate secretions there is most commonly an irritation of the organs, the removal of which will abate the discharge. And herein lies the incrassating quality of this medicine, in that the twitching sense upon the membranes of the lungs, bowels, *etc.* being now lessened, the sharp humor is suffered to lodge there in a greater quantity, before it is so troublesome as to be thrown off and expell'd : it being all one as if there were no irritation of the part, if the uneasy

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sense

sense thereof be not regarded by the mind.

THESE effects will all be heightened by the mixture of the opiate particles with the blood ; which is hereupon rarefied, and distends its vessels, especially those of the brain : and this does still to a greater degree lessen the influx of the nervous fluid to the parts, by pressing upon the little *tubuli*, or canals, thro' which it is derived.

THIS is the reason of that difficulty of breathing, which they for a time experience, who take this kind of medicine : this symptom being inseparable from the rarefaction of the blood in the lungs.

FROM hence it appears, that the action of *Opium* is very analogous

logous to that of other volatil spirits, only that a small portion of it has a force equal to that of a greater quantity of most of them.

THIS is very evident in those, who accustom themselves to take large doses of it ; as the *Turks* and *Persians* do to that degree, that it is no uncommon thing there to eat a drachm or two at a time : for the effects of it in them are no other than downright drunkenness ; upon which account (*a*) it is as common a saying with them, and on the same occasion, “ he has “ eat Opium ; ” as with us, “ he “ has drank too much wine.”

NEITHER indeed do they otherwise bear such large quantities of it, than our tiplers will a great

(*a*) Vid. Belon. Voyag. lib. iii. c. 15.

deal of brandy: that is, by habituating themselves to it by degrees, beginning with small doses, and requiring still more and more to raise themselves to the same pitch. Just as *Galen* (*b*) tells us of a woman at *Aibens*, who by a gradual use had brought herself to take, without any hurt, a considerable quantity of *cicuta*, or hemlock. Which instance is the more to our purpose, because *Nic. Fontanus* (*c*) knew one, who being recovered of the plague, and wanting sleep, did, with very good effect, eat hemlock for some time; till falling ill again of a fever, and having left off the use of this remedy, he endeavoured to procure rest by repeated doses of *Opium*, which (nature having been accustomed

(*b*) *Simpl. Medicam. Facult. lib. iii. c. 18.*

(*c*) *Respons. et Curat. Medic. p. 162.*

to a stronger alterative) had no operation, till the help of *cicuta* was again called in with desired success.

It is a sufficient confirmation of all this reasoning, that *Prosper Alpinus* (*d*) observed among the *Egyptians*, those who had been accustomed to *Opium*, and were faint and languid thro' want of it, (as drinkers are if they have not their liquor) to be recovered, and put into the same state of indolence and pleasure, by large doses of *Cretic* wine made hotter by the infusion of pepper, and the like strong aromatics.

NOR is it perhaps amiss to remark, that in *maniacal* people, as is frequently observed, a quadruple

(*d*) Medicin. Aegypt. lib. iv. c. i.

dose of *Opium* will scarce produce any considerable effect. Now in persons so affected, the mind is deeply engaged and taken up with some images, or other, as love, anger, *etc.* so that it is not to be so easily moved or diverted by those pleasing representations, which it would attend to at another time, and upon which the virtues of this medicine in a great measure depend. Besides this, those who are *maniacal* do to a wonder bear the injuries of cold, hunger, *etc.* and have a prodigious degree of muscular force; which argues the texture of their blood to be very strong, and the cohesion of its globules great: so that the spirituous parts of the opiate cannot make that disjunction and rarefaction of this fluid in them, which it does in ordinary bodies and constitutions.

MANY are the improvements, which might be made of this theory, with relation to the practice of physic: but these will be obvious enough to one instructed in the animal oeconomy.

I CANNOT, however, omit two useful remarks from it. The first is, that by not understanding the manner, in which this noble medicine acts, when it checks immoderate secretions, physicians are often led into wrong methods, and give it to stop those evacuations, in which there are no spasms or painful irritations; as particularly, in colliquative *Diarrhoea's* attending hectic fevers: whereas, it is manifest, it must in such cases (without the desired effect) do real mischief, by relaxing the fibres, and heating and
5 rarefying

rarefying the fluids, already too thin and broken in their texture.

AND, on the other hand, it is easily seen, that this same property, by which it takes off cramps in the nerves, and thus cures excretions depending upon them, will very often happily promote those discharges which are natural, when they are unseasonably interrupted by violent contractions. Thus opiates, in *nephritic* pains, move the urine stopped by gravel and stones; and, in *uterine* cases, assist nature in propelling the *menfes*, the *foetus* and the *lochia*.

To conclude then, it is very plain, that there needs no more to make *Opium* prove destructive or a poison, than to take too great a quantity of it: for then it must inflame the

the stomach, and rarefy the blood to such a degree, that the vessels cannot again recover their tone; whereupon apoplectic symptoms, *etc.* will insue.

To be convinced of this, I forced into the stomach of a small dog about half a drachm of crude *opium* dissolved in boiling water. He quickly vomited it up with a great quantity of frothy spittle; but repeating the trial, by holding up his head, and beating him, I made him retain three or four doses, intermitting between each about a quarter of an hour. When he had thus taken, as I could guess, near two drachms, I watched him about an hour: then he began to sleep, but presently started up with convulsions, fell into universal tremblings, his head constantly twitched and shaking, he breathed

short and with labour, lost intirely the use first of his hinder legs, and then of the fore ones, which were stiff and rigid like sticks. As he lay snorting, to hasten his end, I was giving him more of the solution; but on a sudden his limbs grew limber, and he died.

OPENING his stomach, I found it wonderfully distended, though empty of every thing but some water and *opium*; parcels of frothy *mucus* swimming in it: the inside was as clean as if scraped and washed from all the slime of the glands, with some redness here and there, as in a begining inflammation. The *pylorus* was contracted. The blood-vessels of the brain were very full: and I took out a large grume of concrete blood from the upper part of
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of it, cutting into the *sinus longitudinalis*, as is not uncommon in apoplectic carcases; but found no extravasated *serum* in the *ventricles*, nor among any of the membranes.

As to the cure in such cases; besides emptying by vomiting, bleeding and blistering, acid medicines and lixivial salts are the proper remedies. These contract the relaxed fibres, and by their diuretic force make a depletion of the vessels. I have particularly, with extraordinary success, given repeated doses of a mixture of *salt of wormwood* with *juice of lemons*. This is the foundation, upon which *van Helmont* prepared his *laudanum cydoniatum*, and *Starkey* his *pacific pill*. Generous wine, which the ancients gave for an *antidote*, can be no other ways useful,

R r 2

ful, than as it dissolves the *resinous* clammy part of the *opium* sticking to the coats of the stomach, and so forwards its expulsion by other helps, which cause a contraction of the muscular fibres.

AS an *Appendix* to this discourse, I shall subjoin an account of another Poison, very different from any we have described, but nearly related to those called *narcotic*.

THIS is the *simple water* distilled from the leaves of the *Lauro-cerasus* or *common laurel*. The bad effects of which were first observed some years since in *Ireland*; where, for the sake of its flavour, it was frequently mixed with brandy.

A SMALL quantity of this killed two women, who drank it, very suddenly. Hereupon a learned physician, surpris'd at the event, (this plant having never been thought to be any ways noxious) made several experiments with it upon dogs, which were afterwards, some of them, repeated here, with the same fatal success (*a*).

FROM all these, but more particularly from observations communicated to me by Dr. *Nicholls*, (which he had made in his anatomical lectures) I shall give a short description of the appearances in the animals put to death in this uncommon way.

(*a*) Vid. Philosoph. Transact. N^o. 418 and 420.

ALL the dogs fell immediately into totterings and convulsions of the limbs, which were presently followed by a total *paralysis*, so that no motion could be excited even by pricking or cutting them.

No inflammation, upon dissection, was seen in any of the internal membranes. The most remarkable thing was, a great fullness and distension of the veins, in which the blood was so fluid, that even the lymph in its vessels was generally found tinged with red.

THE same water, injected, as a clyster, into the intestins, had always the like effects, in a very few minutes.

To make the manner of acting of this poison more evident, Dr. *Nicholls*

Nicholls prepared a quantity of it much stronger than ordinary, by *cobobating*, (as the chemists call it) or distilling it twice from fresh leaves. By this proceeding, he had about a drachm of a heavy oil, of the colour of olive oil, subsiding at the bottom of about three pints of water: this, by frequent shaking was quite incorporated again with the water.

ABOUT two ounces of this killed a middle-sized dog, in less than half a minute, even while it was passing down the throat.

I DON'T know a more convincing proof of what I have all along affirmed, that all poisons act principally upon the nervous fluid, than this seemingly innocent water gives us. That a simple liquor, without any extraordinary sensible qualities,

qualities, should even in its passage into the stomach, nay when thrown into the lower guts as a clyster, instantaneously kill, and that without any marks of inflammation or corrosion, can no other way be accounted for, but by an immediate effect upon the animal spirits.

IF what I have, in the Introduction, conjectured concerning the nature of the nervous fluid, be right; the *elastic matter*, which enters into its composition, must in the membranes suffer a *repulsion* from some active particles in this water: (as we see in many experiments of *electricity*, it is in this manner affected by several bodies meeting with it) in consequence of which, the nerves, first of the membranes which it touches, and then of all the organs, must lose their action. Hence it is that ani-

5 animals

mals killed this way, after strong convulsions, die universally paralytic: and a sudden stop being put to the circulation, the blood remains in perfect fluidity in the veins.

MORE will be said to this purpose in the following Essay. I shall only add here, that the deadly power of this water seems to be intirely owing to its being over-saturated with that *heavy oil*, which we have mentioned: and therefore Dr. *Nickolls* experienced, that ten drops of a *red oil*, (like to this, of a *kernelly* flavour and taste) distilled in the same manner from *bitter almonds*, (after the sweet oil had been expressed) mixt with an ounce of common water, in like manner, killed a dog in about half an hour.

CONSIDERING all this, and that it would be a confirmation of what I have asserted, if the application of such substances, as draw back the spirits to their membranes, should, by an irritating force, contrary to the repelling liquor, revive the dying animal; we gave to a small dog about an ounce of strong *laurel water*. He fell immediately into most violent convulsions, which were soon followed by a total loss of his limbs. When he seemed to be expiring, we held to his nostrils a phial of good spirit of *sal ammoniac*, and forced a small quantity of the same down his throat: he instantly felt its virtue, and, by continuing the use of it for some time, by degrees recovered the motion of his legs; and, in about two hours, walked about with tolerable strength,

I

strength, and was afterwards perfectly well.

THE *antidote* shews the nature of the *poison*; and I make no doubt but the same will prove effectual against any others of this kind, which, without an inflaming quality, stupefy, and stop the motion of the nervous fluid.

I GIVE this hint, because it is well known, that the kernels of some fruits, particularly of *black cherries*, afford by distillation a water, in taste and smell, not unlike to that from laurel or bitter almonds: which, if drawn off very strong, or over-impregnated with the heavy oil, may certainly cause the like bad symptoms. Some trials, as I am informed, have proved this to be so. Upon this account, I think our shops had

better be without this water; especially since it is not known to have any medicinal virtue, and is commonly given to infants, easily affected, and subject to convulsions, the very disorder, which waters of this kind have been found to produce.

ESSAY VI.

*Of venomous exhalations
from the EARTH, poi-
sonous AIRS and WA-
T E R S.*

BESIDES these already treated of, there is yet another way of being poisoned, and that is by *venomous steams and exhalations*, or a poisonous air taken into the body by the breath.

THIS

THIS is notorious enough, and authors upon many occasions make mention of it; but when they come to explain the particular manner how this kills, they most commonly reduce it to some of the poisons, which prove destructive by being admitted into the stomach: alledging that malignant fumes and airs are therefore fatal, because impregnated with *arsenical*, *mercurial*, and the like hurtful *μιάσματα* or particles, they convey these into the body; which being of a very corrosive nature, must necessarily do hurt both to the fluid and solid parts.

AND indeed that the fumes of these same minerals are very pernicious, and air filled with their atoms very unfit for respiration, is most certain; but to argue from
hence,

hence, that all deadly vapours and malignant airs owe their mischief to these only, is too fond and ill-grounded a conceit: since upon a due inquiry it will appear, that there may be, and are, mortiferous exhalations from the earth, infecting the air, of a nature so different from any of those poisons, that the very substance, from which they arise, may not be at all hurtful, though taken into the stomach it self.

VENOMOUS steams and damp from the earth the *Latins* in one word called *mephites* (a).

THIS, as many other *Tuscan* words, comes from a *Syriac* theme,

(a) Virgil. Aen. vii. y. 8.

——— Saevamque exhalat opaca mephitim.

Vid. Servium, ibid.

which

which signifies to blow or breathe (*b*). And in ancient times several places were remarkable for them: so the *Mephitis* of *Hierapolis* was very famous, of which *Cicero*, *Galen*, but more particularly, and from his own sight and knowledge, *Strabo* (*c*) makes mention.

SUCH another was the *specus Corycius* in *Cilicia*, which, upon the account of its stinking deadly air, such as is thought to proceed from the mouth of dragons, which the poets give to *Typhon*, was called *cubile Typhonis*. This *Pompon. Mela* (*d*) describes; and it is indeed as ancient as *Homer* (*e*):

(*b*) Scaliger, Conject. in Varron.

(*c*) Lib. xiii.

(*d*) De Situ Orb. lib. i. c. 13.

(*e*) 'Εν Ἀείμοις ὅθι φασὶ Τυφῶεσσι ἔμμελαι
 εὐνάς. Il. β. ᾧ 783.

for *Arima*, in which he places it, was, as *Eustathius* observes, a mountain of *Cilicia*.

NEITHER are such fumes as these now infrequent; and tho' mostly found in mines, pits, and other subterraneous places, yet they are sometimes met with on the surface of the earth too, especially in countries fruitful of minerals, or pregnant with imbowelled fires: such are *Hungary* and *Italy*, which latter, as *Seneca* (*f*) takes notice, has always been remarkable for them.

I SHALL therefore, having had the opportunity of making some remarks upon one of the most famous of all in those parts, give as good an account as I can of that, and its manner of killing; which

(*f*) Nat. Quaest. l. vi. c. 28.

though I dare not affirm to be applicable to any *mephitis* whatsoever, yet seems plainly to be the case of most of them : and where it is not, this simple mischief will only be found to be complicated with another ; and then some extraordinary symptoms or appearances in the animals killed, will easily make a discovery of the additional venom and malignity.

THIS celebrated *Mofeta*, taken notice of (or at least some other hereabouts) even in the time of *Pliny* (g), is about two miles distant from *Naples*, just by the *Lago d' Agnano*, in the way to *Pozzuolo* or *Puteoli*, and is commonly called *la Grotta de' Cani*: because the experiment of its deadly nature is frequently made upon dogs ;

(g) Nat. Hist. l. ii. c. 93.

though it be as certainly fatal to any other animal, if it come within the reach of its vapour: for *Charles the eighth of France* proved it so upon an ass; and two slaves put into it by order of *D. Pietro di Toledo*, viceroy of *Naples*, with their heads held down to the earth, were both killed (*b*).

It is a small *grotta* at the foot of a little hill, about eight feet high, twelve long, and six broad. From the ground arises a thin, subtle, warm *fume*, visible enough to a discerning eye, which does not spring up in little parcels here and there, but is one continued steam, covering the whole surface of the bottom of the cave; and has this remarkable difference from common vapours, that it does not, like

(*b*) L. di Capoa delle Moset. pag. 37.

smoak, disperse it self into the air, but quickly after its rise falls back again, and returns to the earth; the colour of the sides of the *grotta* being the measure of its ascent: for so far it is of a darkish green, but higher, only common earth, and this is about ten inches. And therefore as I found no inconvenience by standing in it, so no animal, if its head be kept above this mark, is in the least injured. But when (as the manner is) a dog, or any other creature, is forcibly held below it, or by reason of its smallness cannot hold its head above it; it presently, like one stunned, loses all motion, falls down as dead, or in a swoon, the limbs convulsed and trembling, till at last no more sign of life appears than a very weak and almost insensible beating of the heart and arteries: which, if the animal be left there
a little

a little longer, quickly ceases too, and then the case is irrecoverable, as in one perfectly strangled. But if it be taken out in time, and laid in the open air, it soon comes to life again; and sooner, if thrown into the adjacent lake, which by constringing the fibres of the skin, in the manner of a cold bath, puts the blood again into its circulation.

It will afford some light towards the knowledge of the nature of this fume, to mention some other experiments made in the *grotta* (i). A lighted torch, snuff and all, goes out in a moment, when dipped into the vapour.

A PISTOL cannot take fire in it. If a weather-glass be so fixed

(i) Addison's Remarks on Italy, p. 230.

in the *grotta*, that the *stagnum* is wholly covered with the vapour; the quick-silver neither falls nor rises otherwise than in the outward air.

IN this short, but accurate history of this *grotta*, I have set down those particulars, which not only distinguish *mephitical* exhalations from common and innocent fumes, but also give hints sufficient, I think, to determine the reason and manner of their surprising effects.

AND not to spend time in refuting the opinion of others, I first take notice, that here can be no suspicion of any such poison as we have described: if there was, animals taken out of the *grotta* could not so immediately recover from the effects of it, without
any

any remaining appearance of faintness, and sickness, or such symptoms as are suffered from inspiring air impregnated with corrosive *effluvia*; and these would certainly, in some degree at least, infect the air in the upper part of the cave, which is always pure and fit for respiration. Neither could a mischief of this kind be produced, without some marks of it in the creatures killed, when opened: which yet discover nothing extraordinary, either in the fluid or solid parts, except what I shall presently mention in frogs.

IN order therefore to understand wherein this deadly power consists, it must be observed, that the use of respiration is twofold; the first, that the blood, in its passage thro' the lungs, may by the elasticity of the air, distending the *vesiculae*,
and

and thus pressing upon the arteries, (*k*) be comminuted and broken, so that no cohesion of its parts may hinder the secretion of those humors, which in the several glands are to be derived from it : the other is, that the blood may be supplied with something from the air, whatever it be, necessary to life.

THAT there is a vivifying matter from the air, which passes into the blood by the breath, I have in another place (*l*) demonstrated by observing, that the same quantity of it will not suffice long for breathing, though it be deprived of none of those qualities, by which it is fitted to inflate the lungs, and

(*k*) Vid. Malpigh. De pulmon. et Bellin. Opuscula.

(*l*) Discourse on the Plague. 9th Edit. pag. 45.

agitate the blood. And likewise, from the experiment of Dr. *Halley*, who, when several fathom under water, in his *Diving Engine*, he breathed an air more condensed than the natural, found that he drew his breath more slowly than usual: the reason of which must be this, that when a greater quantity of air than ordinary was taken in at a time, and consequently the blood furnished with more of those particles, which are necessary to be mixed with it, a less frequent respiration sufficed.

THE case being thus, since (as we have mentioned) the mercury in the barometer is not altered in its ascent by this vapour, that is, there is no want of gravity and elastic pressure in it, at least not to a considerable degree; we must conclude, that there is some quality in it, which,

U u when

when it is drawn into the lungs, prevents and stops the usual communication of the invivifying spirit from the air to the blood.

WE have already taken notice, that there can be no real poison here. All that is discovered by the earth from which the fume arises, is no more than that it is of a greenish colour, with a subacid taste, very much (as *L. di Capoa* observes) like to that of the phlegm of vitriol: so that it may very well be called an unctuous vapour, of the *vitriolic* kind, raised by a subterraneous heat.

It is certainly necessary to the inflation of the *pulmonary vesiculae*, and the subsequent entrance of the subtil matter from the air into the blood, that the nervous liquor should have a free course
into

into them : it is therefore highly probable, that these vitriolic particles in the fume have a counter-action or repulsive force to the elastic matter of this liquor ; by means of which the *fibrillae*, into which it should pass, being destitute of it, become quite relaxed and lose their force (*m*).

NEITHER must it seem strange, that the animal spirits should be so suddenly interrupted in their action, by the interposition of a ponderous fluid ; since we see every day how instantaneously, on the other hand, their motion is quickened and revived by the application, to the nostrils, of volatil salts : and it may be observed, that these are always *alcaline*, that is, of a nature quite opposite to *vitriolic*

(*m*) Vid. Essay V. at the end.

or acid spirits, so as readily to fall into a conflict or fermentation with them.

To conclude this part of our discourse; I think it a sufficient confirmation of this reasoning, that in frogs killed in this *grotta*, the bladders of the lungs (more visible otherwise and distinct in these creatures than in most other) were found subsided and quite empty of air (*n*). But if any one desires a farther proof, he may, according to these principles, make, as *L. di Capoa* did, (*o*) an artificial *Mephitis*: for if *Antimony*, *Bismuth*, or any other such mineral, be finely powdered, and moistened with *Aqua fortis*, or *Spirit of Nitre*; there will arise a great heat, with a thick

(*n*) *L. di Capoa*, *Mofet.* pag. 40.

(*o*) *Ibid.* pag. 128.

dark smoak, in which, as in this *grotta*, torches are extinguished, and animals, though but slowly, stifled and killed.

THE mortal effects of *subterraneous damps*, in mines, deep wells, and the like close places; as also of the fumes of confined burning charcoal, may be accounted for in the same way: these being generally acid exhalations from mineral substances (*p*). And as in animals, which have died in the described *grotta*, the vesicles of the lungs are found subsided, wanting due tension from the animal spirits; so in the dissection of a man killed by the vapour of wood coals, carried from a baker's oven into a deep cellar, as the story is related in the *Memoirs of the Royal Aca-*

(*p*) Vid. *Philos. Transf.* N^o. 411. et 429.

demy at Paris (q), the brain appeared dry, and the muscles of the arms and thighs so relaxed, that they seemed separated from the parts, to which they belonged.

BUT it must here be observed, that, in some cases of this nature, the mineral particles are mixed with so small a proportion of water, that, instead of extinguishing a flame, they will themselves, like gunpowder, take fire, and burn at the approach of a candle. A famous instance of such a vapour is given in our *Philosophical Transactions* (r): and an experiment made by a mixture of oil of vitriol and filings of iron, confirms the truth of our reasonings on this head.

(q) Ann. 1710. pag. 17.

(r) N^o. 442.

THUS I have shewn how death may enter at the nostrils, though nothing properly venomous be inspired. It might perhaps be no difficult matter to shew, how a lesser degree of this mischief may produce effects, though seemingly very different from these now mentioned, yet in reality of the same pernicious nature; I mean, how such an alteration of the common air, as renders it in a manner *me-phitical*, (which is done by too much heat, and at the same time too great a proportion of watery and other grosser particles mixt with it) may be the cause of epidemic diseases, and, it may be, more especially of those, which, by reason of their untoward symptoms, are usually called malignant.

FOR

FOR it is very remarkable, that *Hippocrates* (*s*) observed the constitution of the air, which preceded pestilential fevers, to be great heats, attended with much rain and southern winds: and *Galen* (*t*) takes notice, that no other than a moist and hot temperament of the air brings the plague it self; and that the duration of this constitution is the measure of the violence of the pestilence. *Lucretius* (*u*) is of the same mind: for in his admirable description of the plague of *Athens*, “ These diseases (says he) “ either come from the air, or arise from the earth,”

Ubi putrorem humida nacta est
Intempestivis pluviisque et solibus icta.

(*s*) Epidem. lib. ii. et iii.

(*t*) De temperament. l. i. c. 4. et Commentar. in epidem. l. iii.

(*u*) Lib. vi. v. 1098.

IN short, the general histories of epidemic distempers almost constantly confirm thus much; and would have done it more, if the vain notion of occult venoms had not prepossessed the minds of authors, and made them regardless of the manifest causes.

AND this is notorious enough in those countries, where malignant diseases are most rife: thus it is a very common observation in the *East-Indies*, that during the dry heats the season is healthful, but when the rains fall immediately upon the hot weather, then unto-ward fevers begin to threaten.

THE same is observed in *Africa*: for (as *Joan. Leo* (x) relates) if

(x) *Histor. Afric.* l. i. c. 1. Vid. *Purchas's Pilgrim*, l. vi. c. 1. *Dapper, Descriptio Afric.* pag. 127.

showers fall there during the sultry heats of *July* and *August*, the plague and pestilential fevers insue thereupon, with which whosoever is infected hardly escapes.

WHOEVER reflects on what has been said of the use of respiration, and considers the propositions of *Bellini*, will easily understand the reason of these events.

THIS great demonstrator has proved, that malignant and pestilential fevers are owing to a viscid and tenacious *lensor* or slime, which first obstructs the capillary arteries, and afterwards, being dissolved by heat, ferments with the blood, and changes it to a mass unequally fluid and glutinous.

Now it is plain, that air, together hot and moist, not having
force

force sufficient to comminute the arterial fluid in the lungs, this, when it arrives at the secretory organs, will, instead of deriving into them their proper liquors, leave its most viscid parts sticking about their orifices, which by degrees make obstructions. These can only be removed by the *impetus* of the succeeding blood, and the agitation of heat: and then this slimy *mucus*, being again taken into the circulation, will, in the nature of a ferment, disturb the whole mass, and alter its natural properties.

I VERY well know, that the authority of *Hippocrates* is brought to support the fancy of a latent aerial poison in some of these distempers: his Θεῖον τι (*something divine* (y)) is construed in this sense.

(y) Vid. Prognostic. et Galen. Comment.

But his best interpreter, *Galen*, understood by this expression no such thing as they mean: on the contrary, he says it is a manifest constitution of the air, prevailing unseasonably, such as himself has described in his Aphorisms (z); and which is the same with that, of which we are discoursing.

MINADOUS (a) therefore rightly remarks, that, in his whole *epidemics*, *Hippocrates* never once mentions any venom as the cause of malignant diseases; and, as to any thing really *divine*, the wise old man in other treatises (b) expressly teaches, “That no disease comes
“ from the gods, one more than
“ another, each acknowledging

(z) Sect. iii. Aph. 11.

(a) De febre malign. lib. i. c. 8.

(b) De aëre, aquis et locis. et De morbo sacro.

“ its own natural and manifest
“ cause.”

BUT it is foreign to our purpose to inlarge on this subject. I shall only hint, that physicians ought therefore to be very cautious in giving, as they often do, in cases of this nature, under the notion of *Alexipharmacs*, such medicines as raise a great heat both in the stomach and blood. Having engaged the *animal spirits* in war with *malignities*, they too often send treacherous auxiliaries to the supposed weak party ; and, by exciting new tumults and disorders, check and interrupt the work of nature, which always endeavours to conquer its enemy by *critical* discharges.

It must indeed be owned, that some malignant fevers are contagious,

gious, and that contagion is a real poison: but the original cause of a disease, and the communication of it, are very different things. Of this I have largely discoursed on another occasion (c): I shall therefore only hint here, that when a fever is communicated by way of infection from one already diseased, this most commonly happens at the latter part of the distemper, that is, (as was observed in the *hydrophobia*) when the fermenting blood is throwing off great quantities of its active particles upon the glands of the most constant and easy secretions: such are those in the surface of the body and the mouth. These therefore being by the air drawn into the lungs of a sound person, and likewise insinuating themselves into the

(c) Discourse on the Plague.

pores of the skin, will affect first the nervous fluid, and then the blood, and produce the like fermentation and disorder, which had been bred in the body from which they arose.

THE way, by which bad food, ill ripened fruits of the earth, *etc.* do often produce malignant and pestilential diseases, is not very different from that, by which we have observed unwholesome airs to be the cause of the like effects. For the juices, with which those supply the blood, being corrupted, must necessarily make a fluid neither fit for nutrition nor the animal secretions : and it is therefore no wonder, if, besides the other symptoms insuing, sore pustules, inflammations, ulcers, *etc.* (more common in fevers from this cause than in any other) are

are raised in the surface of the body.

IT is upon this account, that a *famine* is very often succeeded by a *pestilence*. And this calamity generally begins among the poorer sort of people, whose diet to be sure is the worst.

IT is a constant observation in countries subject to the plague, as *Turkey* and *Africa*, that when the common inhabitants die in great numbers, foreigners who live in plenty, if they avoid communication with the infected, escape the danger.

THUS much concerning poisonous exhalations and airs, so far as the consideration of the *grotta de' cani* has led us on to inquire in-
to

to their effects. For though there may be other alterations of this same element, differing in their nature from this we have insisted upon, and yet equally pernicious and hurtful; yet we take no notice of any of them, in regard that those, which are from arsenical, mercurial, and the like fumes, are reducible to a foregoing Essay: and those, which are owing to a change of the known properties of the air, may be easily explained by what has been already delivered in this. I shall therefore rather chuse to make some remarks on the mischief of another fluid, which as it is the next in use to this we have been treating of, so the bad qualities of it, when it comes to be altered, must necessarily be almost equally fatal and dangerous.

I MEAN water, which is of so constant service, not only for our drinks, but also in preparing of our flesh and bread, that it may justly be said to be the vehicle of all our nourishment: so that whenever this happens to have other properties than are necessary to fit it for this purpose, it is no wonder if in its passage through the body these make suitable impressions there.

THUS at *Paris*, where a part of the city is supplied with a water from *Arcueil*, which is so full of stony particles, that even the pipes, through which it runs, are in time incruited and choked up; Dr. *Lister* has observed, that the inhabitants are more subject to the
stone

stone in the bladder, than in most other places (*d*).

IN like manner, let the gross particles, with which the water is saturated, be of any other nature, *metallic, saline, etc.* these, according to their various gravity, the capacity of canals, and such like circumstances, will, when they come to circulate in the animal body, be by the laws of motion deposited in one part or other. So those mineral bodies, and nitrous salts, which abound in the snowy waters of the *Alps*, do so certainly stuff and enlarge the glands of the throat in those who drink them, that scarce any who live there are exempted from this inconvenience (*e*).

(*d*) Vid. Lister's Voyage to Paris.

(*e*) Quis tumidum guttur miratur in Alpibus?
Juvenal. Satyr. xiii.

FOR this reason, the choice of water for drink among the ancients was by weight, the lightest being preferred, as most free from all heterogeneous bodies.

THE case therefore of poisonous springs is, their having corrosive corpuscles mixt with their water, which cannot fail, when forsaken of their vehicle in the canals of the body, to do the same mischief as they would, if taken by themselves undiluted: only with this difference, that they may in this form be carried sometimes farther into the animal oeconomy, and so, having passed the *primae viae*, discover their malignity in some of the inmost recesses. Thus the *fons ruber* in *Aethiopia*, men-

(f) Lib. xxxi. cap. 2.

tioned by *Pliny* (*f*), about which abundance of native *minium* or *cinnabar* was found, shewed its ill effects chiefly on the brain: and therefore *Ovid* (*g*) says of it,

Si quis faucibus hausit,

Aut furit, aut patitur mirum gravitate
soporem.

We shall not need then to enlarge on this matter; since any of the forementioned mineral poisons may thus impart their deadly quality to waters: and accordingly there are instances of *arsenical*, *mercurial*, *etc.* fountains, of which the histories may be seen in the collections of the learned *Baccius* (*b*); and one very remarkable in the *Philosophical Transactions* (*i*).

(*g*) *Metamorph.* lib. xv.

(*b*) *De Therm.* lib. vi.

(*i*) Number 8.

BUT as we before took notice concerning *airs*, so it may be worth the while to observe of *waters*; that there are some alterations of them, which though not properly poisonous, yet are of so great consequence in their effects, that they may very well deserve to be regarded.

THIS I shall do with respect to a great abuse, committed in this kind about the city; and that is, in chusing sometimes stagnating impure well-water for the brewing of beer, and making other drinks. Such a fluid indeed has oftentimes a greater force and aptness to extract the tincture out of malt, than is to be had in the more innocent and soft liquor of rivers: but for this very reason it ought not, unless upon mere necessity, to be
made

made use of; this quality being owing to the mineral particles and aluminous salts, with which it is impregnated.

A LATE author (*k*), by searching into the first accounts of the distemper we call the *Scurvy*, described by *Pliny* (*l*) and *Strabo* (*m*), under the promiscuous names of *stomacace* and *scelotyrbe*; and examining the authentic histories of it in later years, made by the most observing physicians in those countries, where it was unhappily revived, as *Olaus Magnus*, *Balduinus Ronsseus*, *J. Wierus*, *Solomon Albertus*, etc. finds that the origin of it was in all times and places charged upon the use of unwholesome stag-

(*k*) Dr. J. H. Scelera aquarum: Or, a Supplement to Mr. Graunt on the bills of mortality.

(*l*) Lib. xxv. c. 3.

(*m*) Geogr. lib. vi.

nating waters. Then by comparing together the clayie *strata* of the earth about the cities of *London*, *Paris*, and *Amsterdam*, he shews, that where the water is worst, there this malady is most rife. So that he has put it out of all doubt, that most of the perplexed and complicated symptoms, which are ranged under this one general name, are in a great degree owing to the ill qualities of this element.

AND indeed *Hippocrates* himself, as he has very plainly deciphered this disease (*n*), by the title of *σπλῆνες μέγαλοι*, or *great spleens*; so he does very particularly in another treatise (*o*) take notice, that drinking of *stagnating well-waters*

(*n*) *Prorrhēt. lib. ii. c. 16.*

(*o*) *De aere, aquis, et locis, sub finem.*

must necessarily induce an ill disposition both of the *spleen* and *belly*.

IF we inquire into the reason of such ill effects, we must consider, that *clay* is a *mineral glebe*, and that the gross particles and metallic salts, with which waters passing through such a bottom abound, are, as Dr. *Lister* (p) observes, not to be mastered, that is, indigestible in the human body. Not only therefore will these cause, as he very well argues, calculous concretions in the kidneys, bladder, and joints, and as *Hippocrates* experienced, hard swellings in the *spleen*; but they must necessarily oftentimes by their corrosive quality twitch and irritate the

(p) De fontib. med. Angl. p. 2. pag. 75. At fossilia sive metallica salia alia atque alia sunt, et nobis et pene igni dixeram indomabilia.

fenfile membranes of the stomach and bowels, and thus hinder and interrupt the digestion of our food. Nay, besides all this, when they come into the blood, it is no wonder if the small canals of insensible perspiration are frequently stopt and obstructed by them : for it is upon this score that *Sanctorius* (q) teaches us, “ that
 “ heavy water converts the mat-
 “ ter of transpiration into an *ichor*,
 “ which being retained, induces a
 “ *cachexy*.”

WHAT mischiefs will insue here-upon every one sees ; not only pains in the limbs, livid spots in the surface of the body, ulcers, *etc.* from the acrimony of the undischarged moisture ; but many besides of those nervous com-

(q) Medic. Static. § ii. Aphor. 6.

plaints,

plaints, which go by the name of *hysterical* and *hypochondriacal*, may take their rise from the same source: for the before cited *Sanc-torius* (r) has remarked, that the *flatus* or *wind*, so inseparable from those cases, is no other than “the
“fluid of perspiration rude and
“unfinished.”

IF these inconveniences are oftentimes not felt, at least not till towards the declining age, in strong and active habits of body; yet I am, from very good experience, assured, that they deserve consideration in weaker constitutions, and a sedentary life, especially of the more tender sex.

(r) Ibid. § 3. Aph. 13. Flatus nil aliud est quam rude perspirabile.

FOR these reasons *Pliny* (*s*) tells us, “ that those waters are
 “ condemned in the first place,
 “ which, when boiled, incrustate
 “ the sides of the vessels :” And that our well-waters do this, no body, who looks into the common tea-kettles, can be ignorant.

AND indeed in ancient times, as that part of medicine, which relates to diet, was more carefully studied, than it is now ; so this point particularly, of which we are treating, was of so great moment, that *Hippocrates*, who wrote the best book (*t*) on the subject that ever was published, has in a

(*s*) Lib. xxxi. c. 3. Damnantur imprimis fontes, quorum aquae decoctae crassis obducunt vasa crustis.

(*t*) De aere, aquis, et locis.

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great measure accounted not only for the diseases, but even for the temper and disposition of the people of several countries, from the difference of their airs and waters.



G. V. Gucht Sculp.

The

The explication of those Figures, which are not explained in the Treatise.

T A B L E 3. the *Scolopendra*.

FIG. 1. *a a.* the claws of the poisoning forceps.

FIG. 2. one of the claws magnified, in which appears the aperture *b*.

FIG. 3. The Scorpion.

a a. The claws.

b. The tail with the sting at the end.

FIG. 4. The sting magnified, to shew one of the flits, out of which issues the poison. *a.*

FIG. 5. The *Tarantula*.

a a. The wounding forceps.

b b. The Feelers.

T A B L E 4.

FIG. 1. The upper part of an expanded leaf of the *Lichen*.

aa.



Fig. 1.

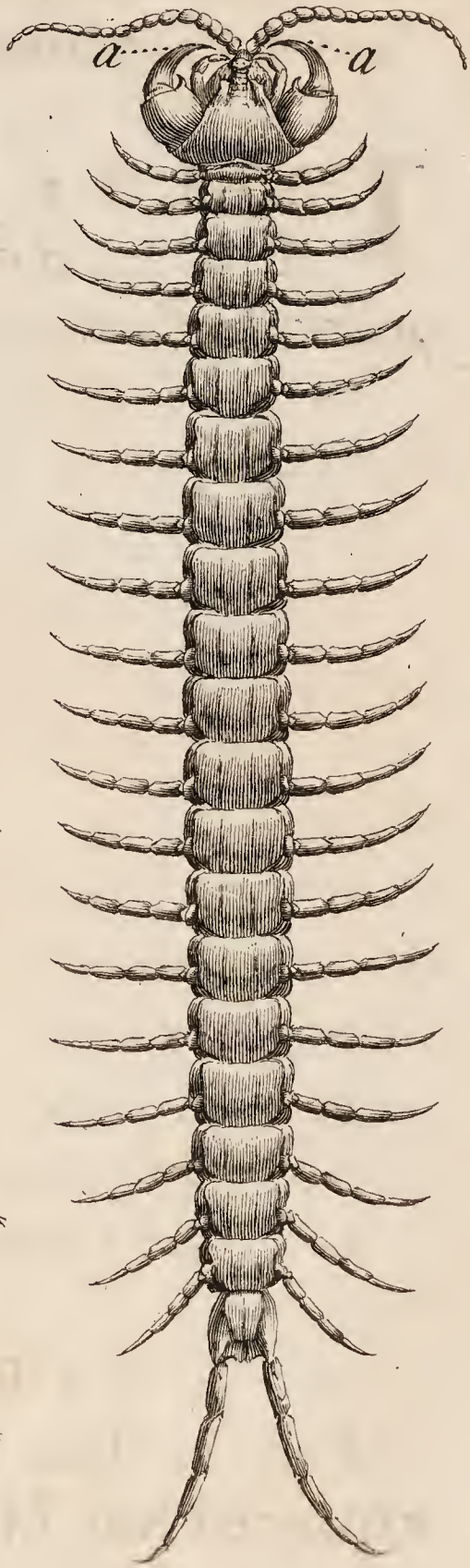


Fig. 3.

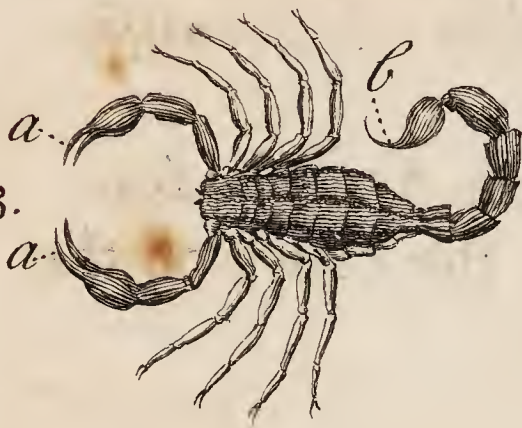


Fig. 2.



Fig. 5.



Fig.1.



Fig.2.



Fig.3.



a a. The *Peltae* or feminal *Cap-sulae*, at the extremities of the leaves.

FIG. 2. The under side of the same leaf, with the *Peltae*.

FIG. 3. A view of a leaf, as it lies on the ground unexpanded.

F I N I S.

E R R A T A.

<i>Pag.</i>	<i>Line</i>	<i>for</i>	<i>read</i>
ix.	7.	manner the	manner of the
160.	16.	Spongia vel Cynorrhodi, Rosae fyl- vestris	Spongia vel Cy- norrhodi, vel Ro- sae fylvestris



